# NORTEL

Nortel Secure Router 8012

# Hardware Description

**Release:** 5.3
**Document Revision:** 01.03

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**ATTENTION**

For information about the safety precautions, read "Safety messages" in this guide.

For information about the software license, read "Software license" in this guide.

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# About this document

## Purpose

This document introduces the Nortel Secure Router 8012 hardware, including the power module, the heat dissipation system, the board, and the equipment cable.

## Related versions

The following table lists the product versions related to this document.

| Product Name | Version |
|---|---|
| Nortel Secure Router 8012 | V200R005 |

## Intended audience

This document is intended for the following audience:

- installers
- network operators
- network administrators
- network maintenance engineers

## Organization

This document consists of five chapters and is organized as follows.

| Chapter | Description |
|---|---|
| 1    Overview | This chapter describes the device structure, the system configuration, and the physical specifications. |
| 2    Power supply | This chapter describes the DC and AC power modules, including the front panel, the functions, and the technical specifications. |

| Chapter | Description |
|---------|-------------|
| 3 Heat dissipation system | This chapter describes the heat dissipation system, including the front panel, the functions and the technical specifications. |
| 4 Boards | This chapter describes the classification of the boards, the slot allocation, the interface types, and the allocation on the boards. It also describes each board according to the functions, the front panel, the interface description, the attributes, and the technical specifications. |
| 5 Cables | This chapter describes the external cables, including the structure and the technical specifications. |
| Appendixes A to C | These sections contain a list of indicators, a list of boards, and a list of acronyms and abbreviations. For daily maintenance, you can use these sections to quickly find information about the device. |

# Conventions

This section describes the symbol and text conventions used in this document.

## Symbol conventions

| Symbol | Description |
|--------|-------------|
| ⚠ DANGER | Indicates a hazard with a high level of risk that, if not avoided, can result in death or serious injury. |
| ⚠ WARNING | Indicates a hazard with a medium or low level of risk that, if not avoided, can result in minor or moderate injury. |
| ⚠ CAUTION | Indicates a potentially hazardous situation that, if not avoided, can cause equipment damage, data loss, and performance degradation, or unexpected results. |
| TIP | Indicates a tip that may help you solve a problem or save time. |
| NOTE | Provides additional information to emphasize or supplement important points of the main text. |

## General conventions

| Convention | Description |
|------------|-------------|
| Times New Roman | Normal paragraphs are in Times New Roman font. |

| Convention | Description |
|---|---|
| **Boldface** | Names of files, directories, folders, and users are in **boldface**. For example, log on as the user **root**. |
| *Italic* | Book titles are in *italics*. |
| Courier New | Terminal display is in Courier New font. |

## Command conventions

| Convention | Description |
|---|---|
| **Boldface** | The keywords of a command line are in **boldface**. |
| *Italic* | Command arguments are in *italics*. |
| [ ] | Items (keywords or arguments) in square brackets [ ] are optional. |
| { x | y | ... } | Alternative items are grouped in braces and separated by vertical bars. You select one item. |
| [ x | y | ... ] | Optional alternative items are grouped in square brackets and separated by vertical bars. You select one item or no item. |
| { x | y | ... } * | Alternative items are grouped in braces and separated by vertical bars. You can select a minimum of one item or a maximum of all items. |
| &<1-n> | The parameter before the ampersand sign (&) can be repeated 1 to *n* times. |
| # | A line starting with the number sign (#) contains comments. |

## GUI conventions

| Convention | Description |
|---|---|
| **Boldface** | Buttons, menus, parameters, tabs, windows, and dialog box titles are in **boldface**. For example, click **OK**. |
| > | Multilevel menus are in **boldface** and separated by the right-angled bracket sign (>). For example, choose **File** > **Create** > **Folder**. |

## Keyboard operation

| Format | Description |
| --- | --- |
| **Key** | Press the key. For example, press **Enter** and press **Tab**. |
| **Key 1**+**Key 2** | Press the keys concurrently. For example, **Ctrl+Alt+A** means press the three keys concurrently. |
| **Key 1**, **Key 2** | Press the keys in sequence. For example, **Alt**, **A** means press the two keys in sequence. |

## Mouse operation

| Action | Description |
| --- | --- |
| Click | Select and release the primary mouse button without moving the pointer. |
| Double-click | Press the primary mouse button twice quickly without moving the pointer. |
| Drag | Press and hold the primary mouse button and move the pointer to a new position. |

# Update history

Updates between document versions are cumulative. Therefore, the latest document version contains all updates made to previous versions.

## Updates in Issue 01 (2008-06-06)

This is the first commercial release of this document.

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# 1 Overview

## About this chapter

The following table lists the contents of this chapter.

| Title | Description |
| --- | --- |
| 1.1 Introduction | This section describes the features of the Secure Router 8012. |
| 1.2 Structure | This section describes the appearance and hardware structure of the Secure Router 8012. |
| 1.3 System configuration and physical specifications | This section describes the system configuration and physical specifications of the Secure Router 8012. |

# 1.1 Introduction

The Nortel Secure Router 8012 is a high-end router developed by Nortel and designed for the carrier aggregation layer and the enterprise backbone layer network. The Secure Router 8012 features include high performance, double Routing Process Units (RPUs), double Network Process Units (NPUs), and hot backup.

The Secure Router 8012 has a modularized structure and provides the High-speed Interface Card (HIC) and the Flexible Interface Card (FIC).

The hardware structure of the Secure Router 8012 provides the following attributes:

- It supports hot swapping.
- The backplane is in the middle. The boards are inserted in the backplane horizontally, allowing easy configuration and maintenance.
- The fan is located to the left of the router backplane. Multiple fans provide heat dissipation.

The Secure Router 8012 also provides an effective monitoring system through the main control module on the RPU. The RPU can manage, monitor, and maintain the board, the fan module, and the power module.

The Secure Router 8012 adheres to electromagnetic compatibility (EMC) and Underwriters Laboratories Inc. (UL) standards. The entire system reaches the module-class shield level. Every front panel is made of steel sheet to isolate the electromagnetic wave between boards.

# 1.2 Structure

The Secure Router 8012 provides the backplane in the middle and an integrated chassis with the board inserted horizontally. The chassis is 6 U in height (1 U = 44.45 millimeters [mm]) and can be mounted in a 19-inch standard cabinet or on the workbench.

# Front panel

**Figure 1-1** Front panel of the Secure Router 8012
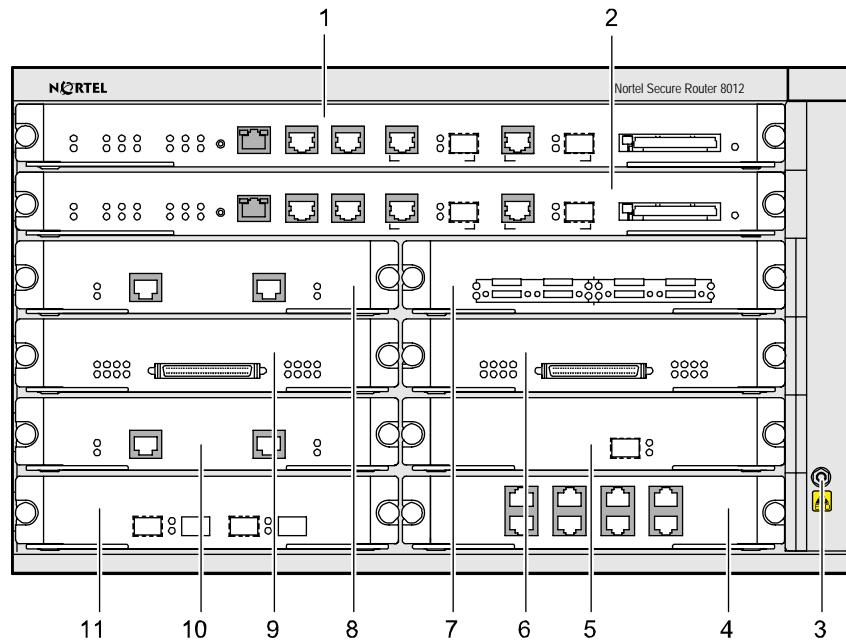


1. RPU 2-slot 10
2. RPU 1-slot 9
3. ESD-preventive wrist strap jack
4. FIC/HIC interface module –slot 2
5. FIC/HIC interface module –slot 4
6. FIC interface module –slot 6
7. FIC interface module –slot 8
8. FIC/HIC interface module –slot 7
9. FIC/HIC interface module –slot 5
10. FIC/HIC interface module –slot 3
11. FIC/HIC interface module –slot 1

## Rear panel

**Figure 1-2** Rear panel of the Secure Router 8012



| | | |
|---|---|---|
| 1. Fan module | 2.NPU 1 | 3. NPU 2 |
| 4.Filler panel | 5.Filler panel | 6. Power module 1 (PWR1) |
| 7.Power module 2 (PWR2) | 8. Grounding screw | 9. AD Power interface |
| 10. Power switch | 11. ESD-preventive wrist strap jack | |
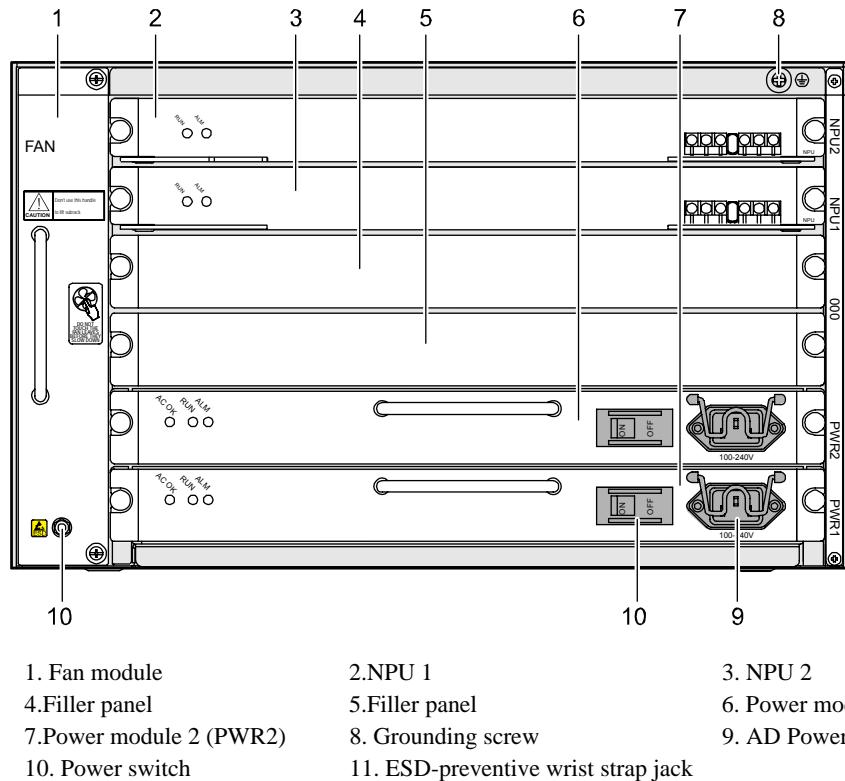
The Secure Router 8012 has an integrated cabinet. The following table provides information about the main components.

**Table 1-1** Secure Router 8012 components

| Name | Description | Detail |
|------|-------------|--------|
| Power module | The power module is located in the two slots at the bottom of the back panel of the cabinet. Every cabinet must be configured with two power modules that are in 1+1 backup mode. The Secure Router 8012 provides an AC or DC power module. | See Chapter 2, "Power supply." |
| Fan module | The fan module is located to the left of the backplane and is used for heat dissipation. Every cabinet must be configured with one fan module. | See Chapter 3, "Heat dissipation system." |
| Board | The four types of boards are RPU, NPU, FIC, and HIC, which can be inserted into the board slots. | See Chapter 4, "Boards." |
| Cable | This component contains the internal power cable, fiber, and the external whole-set cable. | See Chapter 5, "Cable." |

# 1.3 System configuration and physical specifications

## 1.3.1 System configuration

The following table shows the system configuration data.

**Table 1-2** System configuration data

| Item | Secure Router 8012 |
|------|--------------------|
| Number of slots | 12 |
| Maximum number of interface boards | 8 |
| Fan backup | Redundancy backup 2 x 4 |
| Power backup | DC or AC power supply modules in 1+1 redundancy backup |
| Fixed interface | 1 AUX port<br>1 console port<br>One 10/100/1000Base-TX Ethernet interface<br>Two 100/1000M Ethernet interfaces |
| CPU | PowerPC 7447<br>967 MHz |
| Boot ROM | 512 KB x 2 |
| SDRAM | 512 MB (default), can be expanded to 2 GB |
| NVRAM | 512 KB |
| Flash | 64 MB |
| Packet transmission rate | 6 Mpps |
| Switching capacity | 16 Gbit/s |
| Transmission attribute | 1Gigabit Ethernet (GE) wire speed transmission |
| Mean Time Between Failure (MTBF) | More than 34.34 years |
| Mean Time To Repair (MTTR) | Less than 60 minutes |
| Availability | More than 0.99999 |

**NOTE**

- Synchronous Dynamic Random Access Memory (SDRAM) stores the communication data between the system and CPU.
- Non-Volatile Random Access Memory (NVRAM) stores critical files, such as the configuration files and the record of the system running state.
- Flash memory stores the operating system and the application program files.
- Boot ROM stores the boot file for system startup.

## 1.3.2 Physical specifications

The following table describes the physical specifications of the Secure Router 8012.

**Table 1-3** Physical specifications

| Item | | Secure Router 8012 |
|---|---|---|
| Cabinet structure | | Integrated cabinet, 6 U high |
| Dimension | Height (H) | 263.9 mm |
| | Width (W) | 436.2 mm |
| | Depth (D) | 480.0 mm |
| Input voltage | AC | Rated voltage range: 100 V AC to 240 V AC, 50/60Hz<br>Maximum voltage range: 90 V AC to 264 V AC, 50/60Hz |
| | DC | Rated voltage range: –48 V DC<br>Maximum voltage range: –72 V DC to –36 V DC |
| Maximum configuration weight | | 32 kg |
| Maximum power consumption | | 320 watts (W) |
| Module consumption | RPU | 30 W |
| | NPU | 58 W |
| Operating temperature | Long term | 0℃ to 45℃ |
| | Short term | –5℃ to 55℃ |
| Storage temperature | | –40℃ to 70℃ |
| Relative humidity (RH) | Long term | 5% RH to 85% RH (non-condensing) |
| | Short term | 0% RH to 95% RH (non-condensing) |
| Storage relative humidity | | 0% RH to 95% RH |
| Long-term operating altitude | | < 3000 meters (m) |
| Storage altitude | | < 5000 m |

📖 **NOTE**

- The temperature and humidity are measured at 1.5 m over the floor and 0.4 m in front of the cabinet. There should be no protection board at the front or back of the cabinet.

- Short-term operation means that the continuous working time does not exceed 48 hours and the accumulated time per year does not exceed 15 days.

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# 2 Power supply

## About this chapter

The following table shows the contents of this chapter.

| Title | Description |
| --- | --- |
| 2.1 Appearance and front panel | This section describes the appearance and the front panel of the power module. |
| 2.2 Functions | This section describes the functions of the power module. |
| 2.3 Technical specifications | This section describes the technical specifications of the power module. |

# 2.1 Appearance and front panel

## 2.1.1 Appearance

The Secure Router 8012 provides two types of power module: AC input and DC input. Figure 2-1 shows the appearance of the AC power module. Figure 2-2 shows the appearance of the DC power module.

**Figure 2-1** Appearance of the AC power supply module
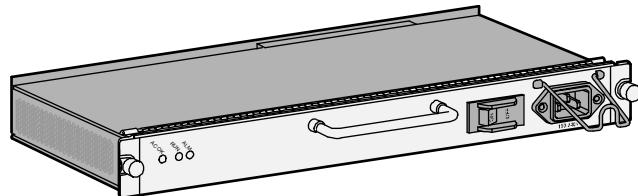
**Figure 2-2** Appearance of the DC power supply module
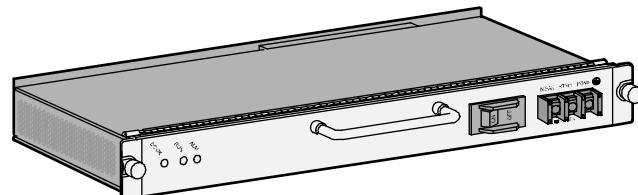
## 2.1.2 Front panel

Figure 2-3 shows the appearance of the front panel of the AC power module. Figure 2-4 shows the appearance of the front panel of the DC power module.

**Figure 2-3**  Front panel of the AC power module
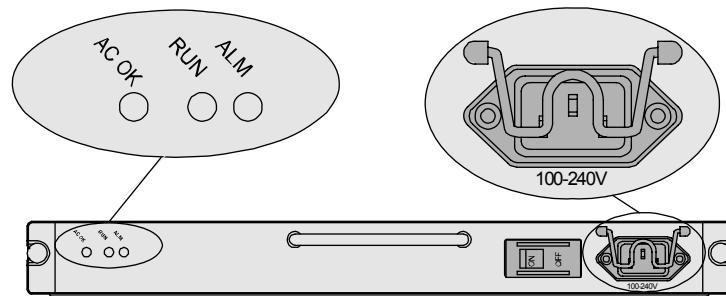
**Figure 2-4** Front panel of the DC power module
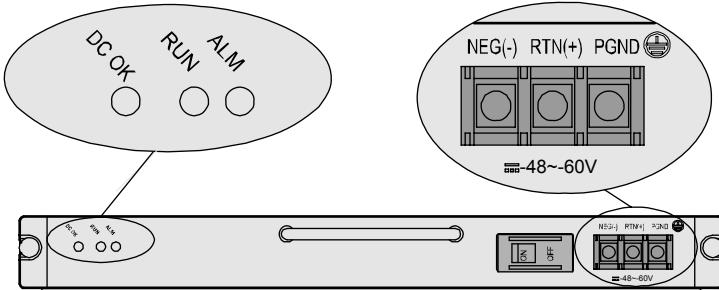


**Table 2-1** Relationship of the terminal block connection of the power input cable

| Identifier of the terminal block | Input cable name | Input cable color | Input cable interface |
|---|---|---|---|
| RTN (+) | Power grounding cable | Black | Core end terminal |
| NEG (-) | Power cable | Blue | |
| ⏚PGND | Protection grounding cable | Yellow and green | Need not be connected. |
| **NOTE**<br>● RTN: Return<br>● NEG: Negative<br>● PGND: Protection Ground | | | |

As shown in Table 2-2 and Table 2-3, you can view the running state of the power module on the indicators of the Routing Process Unit (RPU) front panel.

**Table 2-2** Description of the indicators on the AC power supply module

| Name | Color | Description |
|---|---|---|
| AC OK | Green | The power module input LED (only for the AC power module).<br>Constant ON means the voltage input is normal (100 V to 240 V), and OFF means the voltage input is not normal. |
| RUN | Green | The power module indicators.<br>Constant ON means the power module runs normally, and OFF means the power module has faults. |
| ALM | Red | The power module fault indicator.<br>Constant ON means the power module has faults or is not in position. |

**Table 2-3** Description of the indicators on the DC power supply module

| Indicator | Color | Description |
|-----------|-------|-------------|
| DC OK | Green | The DC input state indicator (only for the DC power module). Constant ON means the voltage input is normal (-48 V to -60 V), and OFF means the voltage input is not normal. |
| RUN | Green | The power module LED. Constant ON means the power module runs normally, and OFF means the power module has faults. |
| ALM | Red | The power module failure LED. Constant ON means the power module has faults or is not in position. |

The running state of the power module is available from the indicators on the RPU front panel. For more information, see Chapter 4, "Boards."

# 2.2 Functions

On the Secure Router 8012, the two types of power modules (AC input and DC input) are inserted into the backplane from the back.

In normal situations, two power modules work in 1+1 hot backup mode. The AC and DC power modules are the PSR550-A and the PSR550-D respectively. The power line uses the –48V feeder cable of D 3PIN.

The power module has the following functions:

- When power input is interrupted or an error occurs with one power module, the other module is not affected and can provide power to the entire system. If the system needs to be powered off, you must power off all the configured power modules.

- The power module provides protection functions, including input over-voltage protection, input under-voltage protection, output over-flow protection, output over-voltage protection, output short-circuit protection, and over-heat protection.

- The power module supports the hot swap feature. Switching the power module does not affect the running system.

📖 **NOTE**

If you want to install a Secure Router 8012 in the communication equipment room, make sure that the power distribution cabinet can provide a lightning protection box or arrester against the current of 20 KA and above.

# 2.3 Technical specifications

The following table describes the technical specifications of the power module.

**Table 2-4** Technical specificationss of the power module

| Item | | Technical specifications |
|---|---|---|
| Dimensions | | 40.14 mm (H) x 350.00 mm (W) x 224.30 mm (D) |
| Weight | | 1.5 kg |
| Input rated voltage<br><br>Input voltage | AC | 100 V AC to 240 V AC<br>50/60 Hz |
| | DC | –48 V DC to –60 V DC |
| Maximum input current<br><br>Input surge current | AC | 85 V AC to 264 V AC<br>50/60 Hz |
| | DC | –36V DC to –72V DC |
| Maximum output current | AC | 10 A |
| | DC | 25 A |
| Input surge current | | 36 A |
| Maximum output current | | 60 A (3.3 V)     20 A (5 V)     30 A (12 V) |
| Maximum output power | | 550 W |

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# 3 Heat dissipation system

## About this chapter

The following table lists the contents of this chapter.

| Title | Description |
| --- | --- |
| 3.1 Appearance and front panel | This section describes the appearance and the front panel of the heat dissipation system. |
| 3.2 Functions | This section describes the functions of the heat dissipation system. |
| 3.3 Technical specifications | This section describes the technical specifications of the heat dissipation system. |

The Secure Router 8012 heat dissipation system consists of the following components:

- fan module
- air filter

The air filter and the fan module are placed separately. The air filter is located to the right of the cabinet backplane. You can clean the air filter by removing it from the back of the cabinet. For information about replacing and cleaning the air filter, see *Nortel Secure Router 8012 – Installation* (NN46240-301).

This chapter describes the fan function, appearance, front panel, and technical specifications for the Secure Router 8012.

# 3.1 Appearance and front panel

## 3.1.1 Appearance

The fan of the Secure Router 8012 is located to the left of the cabin backplane. It ventilates the panel and dissipates heat. The fan supports hot swapping.

The fan module contains the fan frame and the fan components. Figure 3-1 shows the appearance of the fan module.

**Figure 3-1** Appearance of the fan in the Secure Router 8012
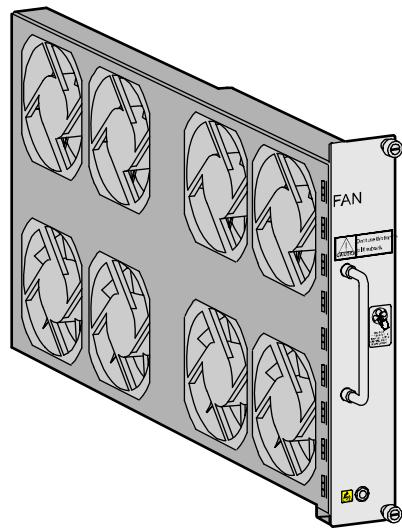


## 3.1.2 Front panel

Figure 3-2 shows the fan module front panel.

**Figure 3-2**  Appearance of the fan front panel of the Secure Router 8012
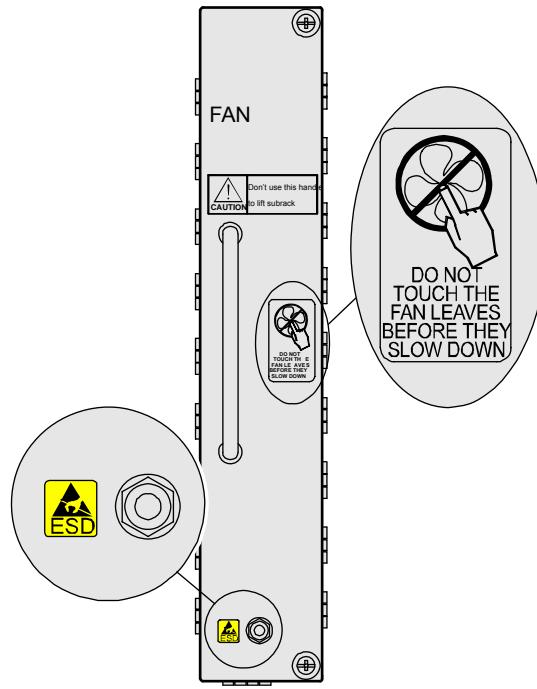


The warning indicators for the state of the fan module are located on the Routing Process Unit (RPU)    front panel. Table 3-1 describes the fan module indicators on the RPU.

**Table 3-1** Description of the fan module indicators

| Name | Color | Description |
|------|-------|-------------|
| RUN | Green | Constant ON means the fan is operating normally. |
| ALM | Red | ON means an error occurred on the fan. |

# 3.2 Functions

The revolution of the fan module is controlled by the RPU. Properly working fans keep the Secure Router 8012 operating at the normal temperature. The fan module functions include the following:

- The fan module can modify the revolution automatically. It configures two parameters, the low-temperature threshold and the high-temperature threshold. The low-temperature threshold and the high-temperature threshold correspond with revs of 100% and 50% respectively. For temperature operation requirements, see Chapter 1, "Overview."

- As the failure of one fan does not affect the operation of other fans, the system can still operate at the normal temperature.

- The system sends out rotation stop alarm signals if any fan fails.

The heat dissipation system of the Secure Router 8012 ventilates the Secure Router 8012. From the top, the air flow enters the Secure Router 8012 from the left and exits from the right. Figure 3-3 shows the air flow inside the Secure Router 8012.

**Figure 3-3** Air flow inside the Secure Router 8012



Fan module frame
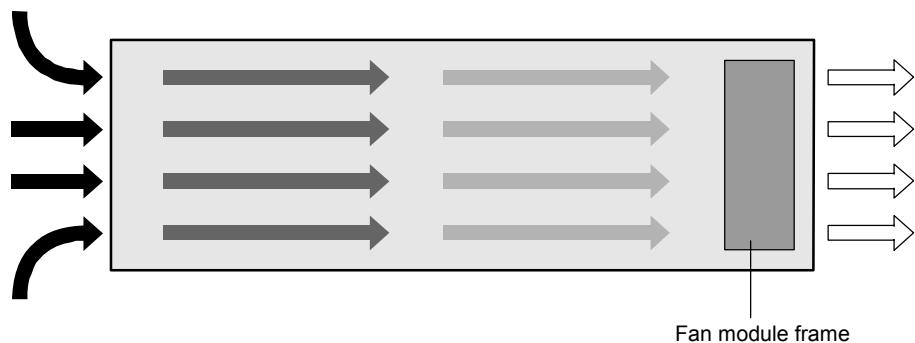
## 3.3 Technical specifications

Table 3-2 shows the technical specifications of the fan module.

**Table 3-2** Technical specifications of the fan module

| Item | Specifications |
|------|----------------|
| Dimensions | 259.45 mm (H) x 47.70 mm (W) x 462.65 mm (D) |
| Power consumption | 38.4 W |
| Maximum blast pressure | 75 Pa |
| Maximum blast volume | 921.6 $m^3$/h |
| Maximum noise | 60 dB |
| Maximum rev | 3800 RPM |
| Operating voltage range | 7.0 V to 13.8 V DC |
| Operating voltage | 12 V DC |

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# 4 Boards

# About this chapter

The following table shows the contents of this chapter.

| Title | Description |
|-------|-------------|
| 4.1 Introduction | This section describes the classification of boards by their function and the models of each type of board; the slots where the boards are inserted; the logical relationship between boards; the appearance of boards; and the classification of boards by interface. |
| 4.2 RPUs | This section describes the functions, front panel, interfaces, and technical specifications of the Routing Process Unit (RPU). |
| 4.3 NPUs | This section describes the functions, panel, and technical specifications of the Network Process Unit (NPU). |
| 4.4 10/100Base-TX electrical interface module | This section describes the functions and front panel of the 10/100Base-TX electrical interface module, and the attributes of the interfaces. |
| 4.5 100Base-FX Ethernet optical interface module | This section describes the functions and front panel of the 100Base-FX Ethernet optical interface module, and the attributes of the interfaces. |
| 4.6 1000Base-X Ethernet optical interface module | This section describes the functions and front panel of the 1000Base-X Ethernet optical interface module, and the attributes of the interfaces. |
| 4.7 Channelized and unchannelized E1/T1 interface module | This section describes the functions and front panel of the channelized and unchannelized E1/T1 interface module, and the attributes of the interfaces. |
| 4.8 Channelized E3 interface modules | This section describes the functions and front panel of the channelized E3 interface module, and the attributes of the interfaces. |

| Title | Description |
|-------|-------------|
| 4.9 Synchronous serial port module | This section describes the functions and front panel of the synchronous serial port module, and the attributes of the interfaces. |
| 4.10 Channelized and unchannelized POS optical interface modules | This section describes the functions and front panel of the channelized and unchannelized Packet Over SDH/SONET (POS) optical interface module, and the attributes of the interfaces. |
| 4.11 HSSI interface module | This section describes the functions and front panel of the High Speed Serial Interface (HSSI) interface module, and the attributes of the interfaces. |
| 4.12 IPSec encryption HIC module | This section describes the functions and front panel of the IP Security (IPSec) encryption High-speed Interface Card (HIC), and the attributes of the module. |

# 4.1 Introduction

This section describes the Secure Router 8012 boards, including board classification, slot arrangement, board appearance, interface type, and interface distribution.

## 4.1.1 Board classification and slot arrangement

### Board classification

The Secure Router 8012 supports the following board types:

- Routing Process Unit (RPU)
- Network Process Unit (NPU)
- Flexible Interface Card (FIC), including:
  - 4-port multiprotocol synchronous serial interface module (4SAE)
  - 4-port unchannelized E1 module (4E1)
  - 4-port channelized E1 module (4CE1)
  - 8-port unchannelized E1 module (8E1)
  - 8-port channelized E1 module (8CE1)
  - 1-port channelized E3 module (1CE3)
  - 4-port channelized T1 module (4CT1)
  - 8-port channelized T1 module (8CT1)
  - 1-port channelized POS optical interface module (1CPOS[E])
  - 1-port HSSI interface module (1HSSI)
  - 2-port HSSI interface module (2HSSI)

📖 **NOTE**

The Secure Router 8012 with the host software version VRP5.30-23134002 or later supports the HSSI interface.

- High-speed Interface Card (HIC), including:
  - 2-Port 100M Ethernet High Speed Electrical Interface Card (RJ45)for Secure Router 8002, 8004, and 8008    (2xFE UTP)
  - 4-Port 100M Ethernet High Speed Electrical Interface Card (RJ45) for Secure Router 8002, 8004, and 8008 (4xFE UTP)
  - 8-port 100M Ethernet High Speed Electrical interface Card (RJ45)for Secure Router 8002, 8004, and 8008 (8xFE UTP)
  - 2-Port Fast Ethernet High Speed Optical Interface Card (SFP) for Secure Router 8002, 8004, and 8008 (2xFE Optical )
  - 4-Port Fast Ethernet High Speed Optical Interface Card (SFP) for Secure Router 8002, 8004, and 8008 (4xFE Optical)
  - 8-Port Fast Ethernet High Speed Optical Interface Card (SFP) for Secure Router 8002, 8004, and 8008 (8xFE Optical)
  - High Speed 1-port 1000M Ethernet card(SFP) for Secure Router 8002, 8004, and 8008 (1xGig E (SFP))
  - High Speed 2-port 1000M Ethernet card(SFP) for Secure Router 8002, 8004, and 8008 (2xGig E (SFP))

- High Speed 1-port 155M POS card(SFP) for Secure Router 8002, 8004, and 8008 (1x155 POS)

- High Speed 2-port 155M POS card(SFP) for Secure Router 8002, 8004, and 8008 (2x155 POS)

- High Speed 4-port 155M POS card(SFP) for Secure Router 8002, 8004, and 8008 (4x155 POS)

- 1-port OC-3/STM-1 CPOS-Channelized E1 Optical Interface Board(SFP) for Secure Router 8012 (1xOC3/STM1 ATM(SFP))

- 1-port OC-3/STM-1 CPOS-Channelized T1-Optical Interface Board(SFP) (1xOC3/STM1 CPOSCT1 (SFP))

- 16-port Channelized E1-DB78-75ohm,Interface Board for Secure Router 8012 (16xCE1 DB78 75ohm)

- 16-port Channelized T1-DB78-120ohm,Interface Board for Secure Router 8012 (16xCT1 DB78 120ohm)

- 1-port OC-3/STM-1 ATM High Speed Optical Interface Board(SFP) for Secure Router 8012 (1xOC3/STM1 ATM(SFP))

- 2-port OC-3/STM-1 ATM High Speed Optical Interface Board(SFP) for Secure Router 8012 (2xOC3/STM1 ATM(SFP))

- 4-port OC-3/STM-1 ATM (HIC) High Speed Optical Interface Board(SFP) for Secure Router 8012 (4xOC3/STM1 ATM (HIC) (SFP))

- 1-port 155M POS (HIC) High Speed Optical Interface Board(SFP) for Secure Router 8012 (1xSTM1/POS-SFP-HIC-SR8012)

- 2-port 155M POS (HIC) High Speed Optical Interface Board(SFP) for Secure Router 8012 (2xSTM1/POS-SFP-HIC-SR8012)

- 4-port 155M POS (HIC) High Speed Optical Interface Board(SFP) for Secure Router 8012 (4xSTM1/POS-SFP-HIC-SR8012)

- IPSEC High Speed Interface Board for Secure Router 8002, 8004, and 8008 (IPSec Module)

## Slot arrangement

Figure 4-1 shows the board slots of the Secure Router 8012.

**Figure 4-1** Arrangement of the Secure Router 8012 slots on the backplane (front view)

| RPU | | 10 | |
|-----|-----|-----|-----|
| RPU | | 9 | |
| FIC | FIC | 7 | 8 |
| FIC | FIC | 5 | 6 |
| FIC | HIC/FIC | 3 | 4 |
| HIC/FIC | HIC/FIC | 1 | 2 |

**Figure 4-2** Arrangement of the Secure Router 8012 slots on the backplane (rear view)

| FAN | NPU2 |
| | NPU1 |
| | |
| | PWR2 |
| | PWR1 |
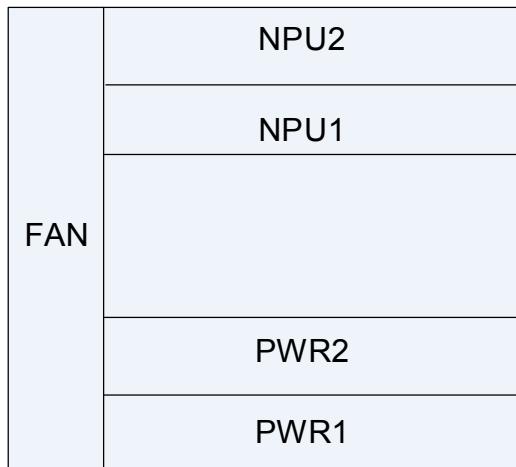
You can insert the RPU into slots 9 and 10 on the top of the front panel of the chassis. You can insert the NPU into the two slots on the top of the rear panel of the chassis. The slots for NPUs and RPUs are positioned back to back.

You can insert an FIC into any of the slots 1 to 8.

You can insert an HIC into any of the slots 1, 2, 3, 4, 5, and 7. The type of HIC, however, is determined by the working mode of the router.

The Secure Router 8012 can operate in two modes: ordinary mode and extended mode. For information about the differences between the two modes, see Table 4-1.

⚠ **CAUTION**

Before hot swapping, run the **preplug slot** *Existing slot number* command in the system view. When information appears indicating that hot swapping is permitted, you can insert or remove boards. Nortel recommends that you substitute the same type of boards during hot swapping.

● To switch from ordinary mode (3HIC) to extended mode (6HIC), first remove the non-extendable HIC from slot 1. Otherwise, you cannot switch from ordinary mode to extended mode.

● To switch from extended mode (6HIC) to ordinary mode (3HIC), first remove the extendable HICs from slots 1, 3, 5, and 7. Otherwise, you cannot switch from extended mode to ordinary mode.

**Table 4-1** Working modes of the Secure Router 8012

| Working mode | Condition |
|---|---|
| Ordinary | One of the following HICs is inserted in slot 1: 2xFE UTP, 4xFE UTP, 8xFE UTP, 2xFE UTP, 4xFE UTP, 8xFE Optical, 1xGig E (SFP), 2xGig E (SFP), 2x155 POS, 4x155 POS, 2xOC3/STM1, 4xOC3/STM1 ATM (HIC) (SFP), or IPSec Module. |

| Working mode | Condition |
|---|---|
| Extended | One of the following HICs is inserted in any of the slots 1, 3, 5, and 7: 16xCE1 DB78 75ohm, 16xCT1 DB78 120ohm, 1xOC3/STM1 CPOSCE1(SFP), 1xOC3/STM1 CPOSCT1 (SFP), 1xOC3/STM1 ATM(SFP), or 1x155 POS HIC. |

Based on the working mode, the slots allow different HICs, as shown in Table 4-2.

**Table 4-2**   Allowed HICs in different modes of the Secure Router 8012

| Working mode | Slot number | | | |
|---|---|---|---|---|
| | 1 | 2 and 4 | 3, 5, and 7 | 6 and 8 |
| Ordinary (3 HICs) | Any of the following HICs: 2xFE UTP SR8002/4/8, 4xFE UTP SR8002/4/8, 8xFE UTP, 2xFE UTP-SFP SR8002/4/8, 4xFE UTP-SFP SR8002/4/8, 8xFE Optical, 1xGig E (SFP), 2xGig E (SFP), 2x155 POS, 4x155 POS, 2xOC3/STM1, 4xOC3/STM1 ATM (HIC) (SFP), IPSec Module | Any of the HICs or FICs | Any of the FICs, but not HICs | Any of the FICs, but not HICs |
| Extended (6 HICs) | Any of the following HICs: 16xCE1 DB78 75ohm, 16xCT1 DB78 120ohm, 1xOC3/STM1 CPOSCE1(SFP), 1xOC3/STM1 CPOSCT1 (SFP) | Any of the HICs or FICs | Any of the FICs, or any of the following HICs: 16xCE1 DB78 75ohm, 16xCT1 DB78 120ohm, 1xOC3/STM1 CPOSCE1(SFP), 1xOC3/STM1 | Any of the FICs, but not HICs |

| Working mode | Slot number | | | |
|---|---|---|---|---|
| | 1 | 2 and 4 | 3, 5, and 7 | 6 and 8 |
| | 1xOC3/STM1 ATM(SFP) 1x155 POS | | CPOSCT1 (SFP) 1xOC3/STM1 ATM(SFP) 1x155 POS | |

📖 **NOTE**

During initialization, the system mode is determined as follows: The router scans slot 1, 3, 5, and 7 in sequence; when the first HIC is found, the router determines the system working mode according to the card type; in the successive scanning, if the router finds that an HIC in a slot breaks the card mixture rule, the slot is marked as ABNORMAL and is not initialized.

During hot swapping, the system mode is determined as follows: The router detects whether the type of card that is inserted into slot 1, 3, 5, or 7 conflicts with the current system mode; if yes, the slot is marked as ABNORMAL and is not initialized.

## 4.1.2 Logical relationship among boards

Figure 4-3 shows the logical relationship among the boards of a Secure Router 8012.

**Figure 4-3** Logical relationship among the boards of a Secure Router 8012
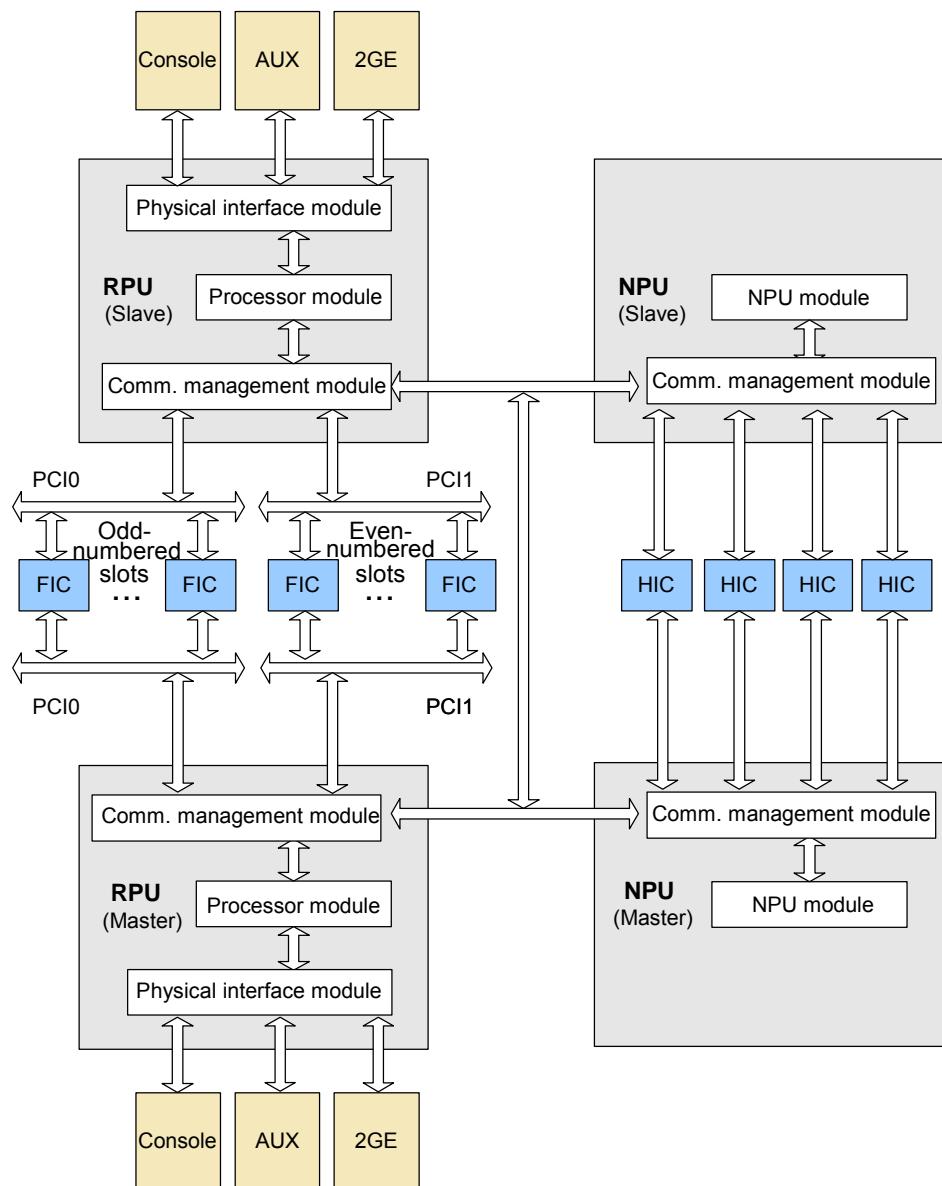


## 4.1.3 Board appearance

⚠️ **CAUTION**

Wear an electrostatic discharge (ESD)-preventive wrist strap and keep it well grounded whenever you touch the board to prevent the ESD from damaging the board.

⚠️ **WARNING**

Do not let your eyes near or stare at the optical interface or the fiber interface. The laser beam is harmful to your eyes.

Figure 4-4, Figure 4-5, and Figure 4-6 show the appearance of the RPU, NPU, and HIC/FIC, using the the 8FE as an example.

**Figure 4-4** Components on an RPU
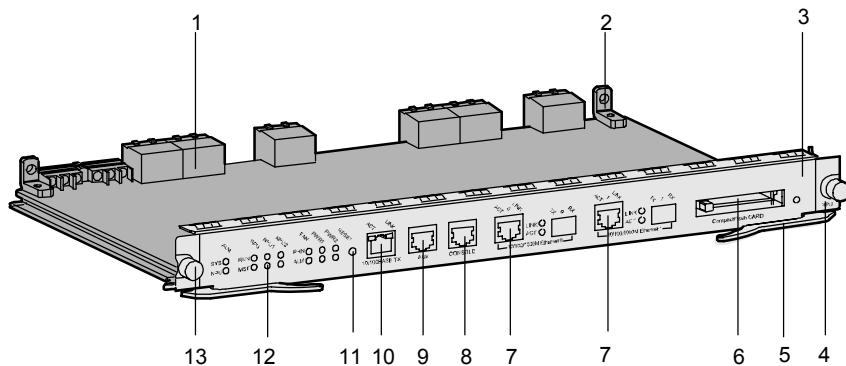


| | | |
|---|---|---|
| 1. Connector | 2.Guiding jack | 3.Board |
| 4.Board silkscreen | 5. Handle | 6. Reserved interface |
| 7. 100/1000M Ethernet interface | 8. CONSOLE port | 9. AUX port |
| 10. 10/100/1000M Ethernet interface | 11. Reset key | 12. Indicator |
| 13. Captive screw | | |

**Figure 4-5** Components on an NPU board
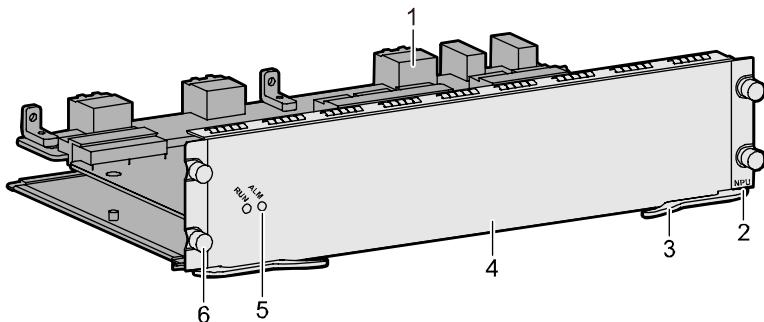


| | | |
|---|---|---|
| 1. Connector | 2. Board silkscreen | 3. Handle |
| 4. Board | 5. Indicator | 6. Captive screw |

**Figure 4-6** Components on an HIC/FIC



| 1. Connector | 2. Front panel | 3. Captive screw |
| 4. Handle | 5. Interface | 6. Board silkscreen |
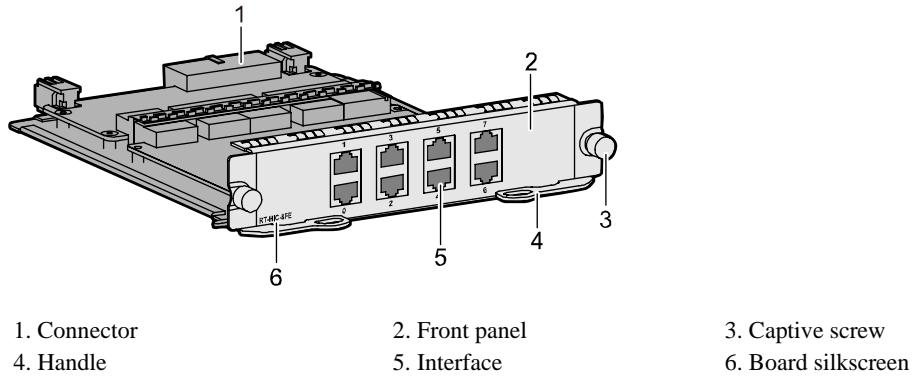
Table 4-3 shows the board dimensions.

**Table 4-3** Board dimensions

| Name | Dimensions |
|------|------------|
| RPU | 399.15 mm (W) x 236 mm (D) x 35.06 mm (H) |
| NPU | 372.45 mm (W) x 238 mm (D) x 35.06 mm (H) |
| HIC/FIC | 198.55 mm (W) x 243.19 mm (D) x 40.14 mm (H) |

# 4.1.4 Interface types and distribution on the boards

All interfaces are integrated on the board and imported from the board. Table 4-4 shows the interface distribution on the boards.

**Table 4-4** Interface distribution on the boards

| Interface classification | Interface name | Interface attribute | Interface type | Board name |
|---|---|---|---|---|
| Optical interface | 100Base-FX Ethernet optical interface | Single-mode optical interface | LC | RT-HIC-2FE-SFP<br>RT-HIC-4FE-SFP<br>RT-HIC-8FE-SFP |
| | | Multi-mode optical interface | LC | RT-HIC-2FE-SFP<br>RT-HIC-4FE-SFP<br>RT-HIC-8FE-SFP |

| Interface classification | Interface name | Interface attribute | Interface type | Board name |
|---|---|---|---|---|
| | 1000Base –FX Ethernet optical interface | Single-mode optical interface | LC | RT-HIC-1GE RT-HIC-2GE RPU |
| | | Single-mode long-haul optical interface | | |
| | | Single-mode ultra long-haul optical interface | | |
| | | Multi-mode optical interface | | |
| | FIC low-speed 155M ATM optical interface | Single-mode optical interface | SC | 1ATM-OC3SM |
| | | Single-mode long-haul optical interface | | 1ATM-OC3SML |
| | | Multi-mode optical interface | | 1ATM-OC3MM |
| | HIC high-speed 155M ATM optical interface | Single-mode short-haul optical interface | LC | RT-HIC-1ATM RT-HIC-2ATM RT-HIC-4ATM |
| | | Single-mode long-haul optical interface | | |
| | | Single-mode ultra long-haul optical interface | | |
| | | Multi-mode optical interface | | |
| | POS optical interface | Single-mode short-haul optical interface | LC | 1CPOS(E) RT-HIC-1POS RT-HIC-2POS RT-HIC-4POS RT-HIC-CPE1 RT-HIC-CPT1 |
| | | Single-mode long-haul optical interface | | |
| | | Single-mode ultra long-haul optical interface | | |
| | | Multi-mode optical interface | | |
| Electrical interface | 10/100Base-TX FE electrical Interface | 10M/100 Mbit/s autosensing | RJ45 | RT-HIC-2FE RT-HIC-4FE RT-HIC-8FE |

| Interface classification | Interface name | Interface attribute | Interface type | Board name |
|---|---|---|---|---|
| Serial port | High-speed synchronous serial port | DTE/DCE | DB-28 | 4SAE |
| Electrical interface of maintenance | Ethernet interface | 10M/100M/1000M bit/s autosensing | RJ45 | RPU |
| | Console interface | — | RJ45 | RPU |
| | AUX interface | — | RJ45 | RPU |
| | E1/CE1 T1/CT1 | • 75 Ω coaxial cable <br> • 120 Ω shielded twisted pair (STP) | • Coaxial connector <br> • RJ45 | 4E1/4CE1/8E1/8CE1 /RT-HIC-16CE1 4CT1/8CT1/ RT-HIC-16CT1 |

# 4.2 RPUs

This section introduces the functions of the Routing Process Unit (RPU), the boards, the interfaces, and the technical specifications for the Secure Router 8012.

The RPU is located in either of the two slots on the top of the chassis. The RPU is installed in the front panel and corresponds with the NPU in the system. The Secure Router 8012 has two types of RPUs: ERPUA (with a memory of 512 MB) and ERPUB (with a memory of 1 GB). For normal operation, the master RPU and slave RPU must be the same type.

## 4.2.1 Functions

The RPU is the main control board of the Secure Router 8012. It consists of the PowerPC processor, system controller bridge, storage, and other attached devices. The RPU monitors the system ports, manages the equipment, and processes various software protocols.

The RPU has the following functions:

- processes the routing protocol
- receives and sends the FIC packets
- manages the interface state
- monitors the state of the power system
- monitors the state of the fan system
- monitors the system temperature
- supports the configuration and management of the active and standby NPUs
- configures and manages the high-speed interface

- supports the active and standby switchover
- supports hot swapping
- supports the hot and cool backup

In addition, the RPU provides two Gigabit Ethernet (GE) ports. It supports the exclusion of the optical function and the electrical function on the GE port; that is, you cannot use the optical function and the electrical function on the GE port at the same time..

## 4.2.2 Front panel

Figure 4-7 shows the appearance of the panel. Table 4-5 describes the components.

**Figure 4-7** Appearance of the RPU front panel
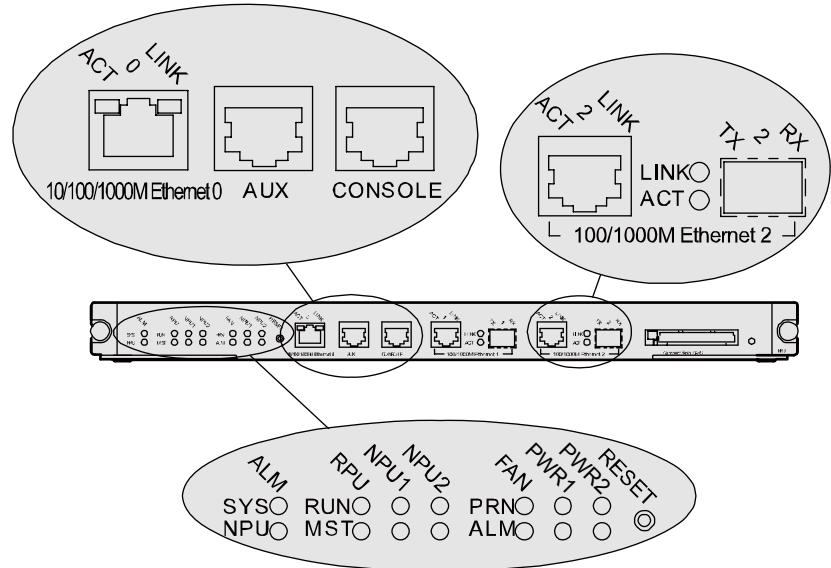


**Table 4-5** Description of the components on the front panel of an RPU

| Name | Silkscreen | Description |
|------|-----------|-------------|
| ALM (red) | SYS | The system running LED, including the fan, power supply, and NPU warnings. Constant ON means the CPU received a warning. |
|  | NPU | The NPU failure LED. Constant ON means the NPU failed. |
| RPU (green) | RUN | The system running LED. Blinking means the CPU works normally. Constant ON or OFF means the CPU failed. |
|  | MST | The standby state LED. On means that the board is the master RPU. |

| Name | Silkscreen | Description |
|------|-----------|-------------|
| NPU1 (green) | RUN | The system running LED. Blinking means the CPU is in normal operation. Constant ON or OFF means the CPU failed. |
| | MST | The standby state LED. On means that the board is the master NPU. |
| NPU2 (green) | RUN | The system running LED. Blinking means the CPU is in normal operation. Constant ON or OFF means the CPU failed. |
| | MST | The standby state LED. On means that the board is the master NPU. |
| FAN | PRN (green) | The fan position LED. Constant ON means the fan is in position or has failed. |
| | ALM (red) | The fan warning LED. Constant ON means the fan is not in position or its rotation is obstructed. |
| PWR1 | PRN (green) | The LED of the first power module in position. Constant ON means the power module is in position. Constant OFF means the power module is not in position. |
| | ALM (red) | The first power module failure LED. Constant ON means that the power module is disabled or has failed. |
| PWR2 | PRN (green) | The LED of the second power module in position. Constant ON means the power module is in position. Constant OFF means the power module is not in position. |
| | ALM (red) | The second power module failure LED. Constant ON means that the power module is disabled or has failed. |
| RESET | | The RPU hardware reset button, which is used to restart the device. |
| 10/100/1000M Ethernet 0 LED | LINK (green) | OFF means the link is not connected and ON means the link is connected. |
| | ACT (yellow) | OFF means no data is being transmitted or received on the interface, and blinking means data is being transmitted and received. |
| 100/1000M Ethernet 1 LED | LINK (green) | OFF means the link is not connected and ON means the link is connected. |
| | ACT (yellow) | OFF means no data is being transmitted and received on the interface, and blinking means data is being transmitted and received. |
| 100/1000M Ethernet 2 LED | LINK (green) | OFF means the link is not connected and ON means the link is connected. |

| Name | Silkscreen | Description |
|------|-----------|-------------|
|  | ACT (yellow) | OFF means no data is being transmitted and received on the interface, and blinking means data is being transmitted and received. |

## 4.2.3 Interfaces

Table 4-6 describes the interfaces on the RPU and their usage.

**Table 4-6** The interfaces on the RPU and their usage

| Item | Description |
|------|-------------|
| Console port | The local debugging serial port. |
|  | It is used to connect the serial port of a PC. The terminal emulation program can run on the PC. |
|  | It can be used as the command line interface (CLI) and also for board or system debugging, testing, serial port printing, background operation, troubleshooting, and online upgrading. |
| AUX port | The AUX port is also called the remote debugging physical interface. |
|  | It provides remote configuration, connects the modem, and establishes the connection with the remote router by dialing. |
|  | When faults occur on the console port, you can use the AUX port as the console port. |
| 10/100/1000M Ethernet port | Provides the remote logon Telnet function and can be used for board or system debugging, testing, background operation, fault diagnosis, online upgrading, and remote operation. |
| 100/1000M Ethernet port | Similar to the 10/100/1000M Ethernet port, this port is used for debugging. |
| Compact flash card | Reserved as the interface. |

## 4.2.4 Interface attributes

Table 4-7 shows the attributes of the console port.

**Table 4-7** Console interface attributes

| Attribute | Description |
|-----------|-------------|
| Connector type | RJ45 |
| Standard | RS-232 |
| Baud rate | 9600 bit/s to 115 200 bit/s |

| | 9600 bit/s by default |
|---|---|

Table 4-8 shows the atttributes of the AUX port.

**Table 4-8** AUX interface attributes

| Attribute | Description |
|---|---|
| Connector type | RJ45 |
| Standard | Asynchronous EIA/TIA-232 |
| Baud rate | 300 bit/s to 115 200 bit/s |
| Supported protocols | Point-to-Point Protocol (PPP) |
| | Serial Line Internet Protocol (SLIP) |
| | Multilink Protocol (MP) |

Table 4-9 shows the attributes of the 10/100/1000M Ethernet port.

**Table 4-9** Attributes of the 10/100/1000M Ethernet interface

| Attribute | Description |
|---|---|
| Connector type | RJ45 |
| Supported frame format | Ethernet_II |
| | Ethernet_SNAP |
| | IEEE 802.2 |
| | IEEE 802.3 |
| Operating mode | 10/100/1000 Mbit/s autosensing |
| | Full duplex |
| | Half duplex |
| Supported network protocol | IP |

Table 4-10 shows the attributes of the 100/1000M Ethernet interface.

**Table 4-10** Attributes of the 100/1000M Ethernet interface

| Attribute | Description | |
|---|---|---|
| Connector type | Small Form-Factor Pluggable (SFP) optical module | |
| Number of interfaces | 2 | 1 |
| Supported frame format | Ethernet_II | |

| Attribute | Description |
|---|---|
| | Ethernet_SNAP |
| Working mode | 100/1000 Mbit/s autosensing Full duplex |
| Supported network protocol | IP |

## 4.2.5 Technical specifications

Table 4-11 shows the technical specifications of the RPU board.

**Table 4-11** Technical specifications of the RPU

| Parameter | Description |
|---|---|
| Silkscreen | RPU |
| Power consumption | 35 W |
| Dimensions | 399.15 mm (W) x 236 mm (D) x 35.06 mm (H) |
| Height of the front panel | 35.06 mm |

# 4.3 NPUs

This section introduces the functions of the Network Process Unit (NPU), the board, and the technical specifications for the Secure Router 8012.

The board is located in the back slot on the bottom of the chassis. An NPU is installed in the system from the back and sits back-to-back with the RPU.

## 4.3.1 Functions

An NPU consists of the network processor module, the Field Programmable Gate Array (FPGA) module, the storage module, and the other attached devices. The board implements expedited forwarding of data packets, including IP forwarding, Multiprotocol Label Switching (MPLS) forwarding, multicast forwarding, and Quality of Service (QoS). The forwarding rate can reach 6 Mpps.

The NPU has the following functions:

- inputs the service data convergence and outputs the service data division
- provides the upstream and downstream of the data convergence module with the QoS guarantee
- encapsulates and decapsulates the data frame after HIC and FIC data enters the network process module

- encapsulates and decapsulates the data frame after high-speed interface control packets enter the network process module

- periodically detects the state of the network process module and queries the board version

- updates the Erasable Programmable Logic Device (EPLD) and FPGA, and implements the online loop and offline loop of FPGA in the board

- monitors the temperature

- supports resetting of the service interface board and other main modules

- supports the CABwatch debugging tool provided by IBM

## 4.3.2 Front panel

Figure 4-8 shows the appearance of the NPU front panel.

**Figure 4-8** Appearance of the NPU front panel
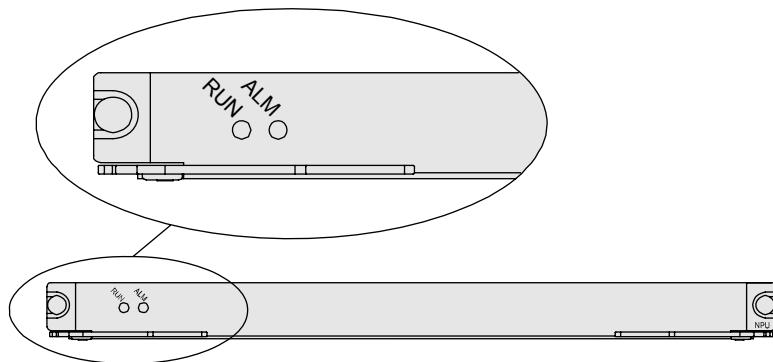


Table 4-12 describes the NPU indicators.

**Table 4-12** Description of the NPU indicators

| Component | Description |
| --- | --- |
| RUN (green) | The running LED. Blinking means the NPU works normally. Constant OFF means the NPU is not in position or failed. |
| ALM (red) | The alarm LED. Constant ON means NPU failed. |

The NPU does not provide external interfaces.

## 4.3.3 Technical specifications

Table 4-13 describes the NPU technical specifications.

**Table 4-13** Description of the NPU technical specifications

| Parameter | Description |
|---|---|
| Silkscreen | NPU |
| Power consumption | 58 W |
| Dimension | 372.45 mm (W) x 238 mm (D) x 35.06 mm (H) |
| Height of the front panel | 35.06 mm |

# 4.4 10/100Base-TX electrical interface module

The 10/100Base-TX electrical interface modules of the Secure Router 8012 are as follows:

- 2-port 10/100Base-TX Fast Ethernet electrical interface module (RT-HIC-2FE)
- 4-port 10/100Base-TX Fast Ethernet electrical interface module (RT-HIC-4FE)
- 8-port 10/100Base -TX Fast Ethernet electrical interface module (RT-HIC-8FE)
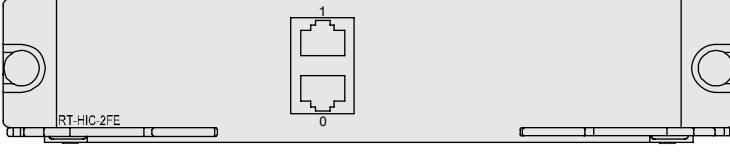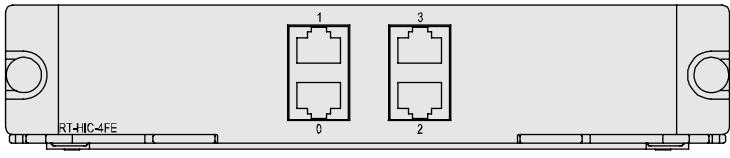
## 4.4.1 Functions

The 10/100Base-TX Ethernet electrical interface module provides Fast Ethernet (FE) interfaces that connect a router and a LAN.

## 4.4.2 Front panel

Table 4-14 shows the appearance of the 10/100Base-TX Ethernet electrical interface.

**Table 4-14** Description of the 10/100Base-TX Ethernet electrical interface module

| Silkscreen | Appearance of the front panel |
|---|---|
| RT-HIC-2FE |  |
| RT-HIC-4FE |  |

| RT-HIC-8FE |  |
|---|---|
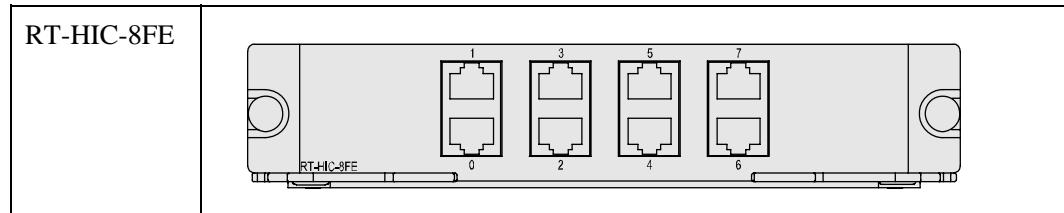
Table 4-15 describes the indicators of the10/100Base-TX Ethernet electrical interface module.

**Table 4-15** Description of indicators of the 10/100Base-TX Ethernet electrical interface module

| LED | Description |
|---|---|
| LINK | OFF means the link is not connected and ON means the link is connected. |
| ACT | OFF means no data is being transmitted or received on the interface and blinking means data is being transmitted or received. A high frequency of blinking means a large data flow. |

## 4.4.3 Interface attributes

Table 4-16 shows the attributes of the 10/100Base-TX Ethernet electrical interface.

**Table 4-16** Attributes of the 10/100Base-TX Ethernet electrical interface module

| Attribute | Description |
|---|---|
| Connector type | RJ45 |
| Cable type | Standard Ethernet cable |
| Transmission distance | 100 m (with Category 5 twisted pair cable) |
| Operating mode | Full duplex/Half duplex<br>10M/100 Mbit/s autonegotiation |
| Compliant standard | IEEE 802.3u |
| Supported frame format | Ethernet_II<br>Ethernet_SNAP |
| Supported network protocol | IP |

# 4.5 100Base-FX Ethernet optical interface module

The 100Base-FX Ethernet optical interface modules of the Secure Router 8012 are as follows:

- 2-port 100Base-FX Ethernet single/multi-mode optical interface module (RT-HIC-2FE-SFP)
- 4-port 100Base-FX Ethernet single/multi-mode optical interface module (RT-HIC-4FE-SFP)
- 8-port 100Base-FX Ethernet single/multi-mode optical interface module (RT-HIC-8FE-SFP)

## 4.5.1 Functions

The 100Base-FX Ethernet optical interface module provides the optical interface. The optical interface enables routers to communicate with the LAN based on the high reliability and high transmission quality of the fiber.

## 4.5.2 Front panel

Table 4-17 shows the appearance of the 100Base-FX Ethernet optical interface module.

**Table 4-17** Description of the 100Base-FX Ethernet optical interface module
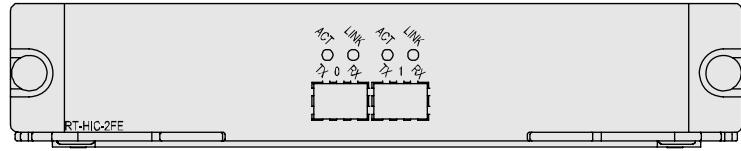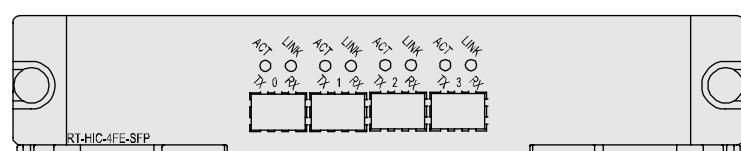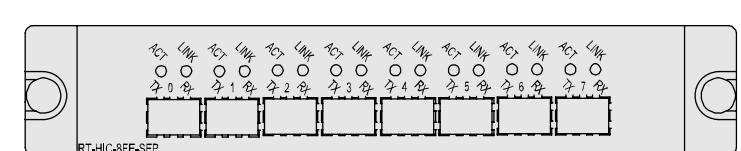
| Silkscreen | Appearance of the front panel |
|---|---|
| RT-HIC-2FE-SFP |  |
| RT-HIC-4FE-SFP |  |
| RT-HIC-8FE-SFP |  |

Table 4-18 describes the indicators of the 100Base-FX Ethernet optical interface module.

**Table 4-18** Description of the indicators of the 100Base-FX Ethernet optical interface module

| Indicator | State and significance |
|---|---|
| LINK | OFF means the link is not connected and ON means the link is connected. |
| ACT | OFF means no data is being transmitted or received on the interface and blinking means data is being transmitted or received. |

### 4.5.3 Interface attributes

Table 4-19 shows the attributes of the 100Base-FX Ethernet optical interface. The SFP optical module is configured separately and its attributes are shown in Table 4-20.

**Table 4-19**  Attributes of the 100Base-FX Ethernet optical interface

| Item | Description |
|---|---|
| Duplex mode | Full duplex |
| Rate | 100 Mbit/s |
| Applicable standard | IEEE 802.3u |
| Supported frame format | Ethernet_II<br>Ethernet_SNAP |
| Supported network protocol | IP |

**Table 4-20**  Attributes of the 100Base-FX Ethernet interface SFP optical module

| Item | | Description | | | |
|---|---|---|---|---|---|
| Maximum transmission distance | | 2 km | 15 km | 40 km | 80 km |
| Central wavelength | | 1310 nm | 1310 nm | 1310 nm | 1550 nm |
| Optical fiber type | | Multimode | Single-mode | Single-mode | Single-mode |
| Transmitting power | Minimum | –19 dBm | –15 dBm | –5 dBm | –5 dBm |
| | Maximum | –14 dBm | –8 dBm | 0 dBm | 0 dBm |
| Receiver sensitivity | | –30 dBm | –31 dBm | –37 dBm | –37 dBm |
| Sender type | | LD | LED | | |
| Connector type | | LC | | | |

## 4.6 1000Base-X Ethernet optical interface module

The 1000Base-X Ethernet optical interface modules of the Secure Router 8012 are as follows:

- 1-port 1000Base-X Ethernet optical interface module (RT-HIC-1GE)
- 2-port 1000Base-X Ethernet optical interface module (RT-HIC-2GE)

## 4.6.1 Functions

The 1000Base-X Ethernet optical interface module provides the Gigabit Ethernet (GE) optical interface that enables communication between routers and the LAN.

## 4.6.2 Front panel

Table 4-21 shows the appearance of the 1000Base-X Ethernet optical interface module.

**Table 4-21** Description of the 1000Base-X Ethernet optical interface module

| Silkscreen | Appearance of the front panel |
|---|---|
| RT-HIC-1GE |  |
| RT-HIC-2GE |  |

Table 4-22 describes the indicators of the 1000Base-X Ethernet optical interface module.

**Table 4-22** Description of the indicators of the 1000Base-X Ethernet optical interface module

| Indicator | State and significance |
|---|---|
| LINK | OFF means the link is not connected and ON means the link is connected. |
| ACT | OFF means no data is being transmitted or received on the interface and blinking means data is being transmitted or received. |

## 4.6.3 Interface attributes

Table 4-23 shows the attributes of the 1000Base-X Ethernet optical interface. The SFP optical module is configured separately and its attributes are shown in Table 4-24.SFP electrical module is configured separately and its attributes are shown in Table 4-25.

**Table 4-23** Attributes of the 1000Base-X Ethernet optical interface module

| Item | Description | |
|---|---|---|
| | 2GE | 1GE |
| Connector type | LC | |

| Item | Description | |
|---|---|---|
| | **2GE** | **1GE** |
| Interface number | 2 | 1 |
| Duplex mode | Full duplex | |
| Rate | 1.25 Gbit/s | |
| Standard compliance | IEEE 802.3z | |
| Frame format | Ethernet_II Ethernet_SNAP | |
| Network protocol | IP | |

**Table 4-24** Attributes of the 1000Base-X Ethernet interface SFP optical module

| Item | Description | | | | | |
|---|---|---|---|---|---|---|
| Transmission distance | 0.55 km | 10 km | 40 km | 40 km | 80 km | 100 km |
| Central wavelength | 850 nm | 1310 nm | 1310 nm | 1550 nm | 1550 nm | 1550 nm |
| Minimum output power | –9.5 dBm | –9.5 dBm | –5 dBm | –4.0 dBm | –5.0 dBm | –5 dBm |
| Maximum output power | 0 dBm | –3.0 dBm | –2 dBm | 0 dBm | –2.0 dBm | 0 dBm |
| Receiver sensitivity | –17.0 dBm | –20.0 dBm | –23 dBm | –22.0 dBm | –23.0 dBm | –30.0 dBm |
| Optical fiber type | Multimode | Single-mode | Single-mode | Single-mode | Single-mode | Single-mode |
| Connector type | LC | | | | | |

**Table 4-25** Attributes of SFP electrical interface module of 1000Base-X Ethernet interface

| Item | Description |
|---|---|
| Transmission distance | 100 m |
| Duplex | Full-duplex |
| Connector type | RJ-45 |

| Item | Description |
|------|-------------|
| Rate | 1000 Mbit/s |

# 4.7 Channelized and unchannelized E1/T1 interface module

The channelized and unchannelized E1/T1 interface modules of the Secure Router 8012 are as follows:

- FIC
  - 4-port unchannelized E1 module (4E1)
  - 4-port channelized E1 module (4CE1)
  - 8-port unchannelized E1 module (8E1)
  - 8-port channelized E1 module (8CE1)
  - 4-port channelized T1 module (4CT1)
  - 8-port channelized T1 module (8CT1)
- HIC
  - 16-port channelized E1 module (RT-HIC-16CE1)
  - 16-port channelized T1 module (RT-HIC-16CT1)

## 4.7.1 Functions

Channelized and unchannelized E1/T1 interface modules can transmit, receive, and process E1/T1 data flow. The channelized E1/T1 module offers access to CE1/CT1 and implements the Integrated Services Digital Network (ISDN) Primary Rate Interface (PRI) function.

The functions are as follows:

- supports the internal and external clocks
- supports the working modes of the remote loops, the local loops, and the frame loops
- supports various link layer protocols, such as PPP, Frame Relay, and High-level Data Link Control (HDLC)

The primary differences between unchannelized E1 interface modules and channelized E1 interface modules are as follows:

- Unchannelized interface modules support binding only once. That is, multiple unchannelized interface modules can be bound with one channel with a speed of 2.048 Mbit/s.
- Channelized interface modules support multiple bindings. That is, 31 channels can be bound into several groups.

The channelized T1 module supports two working modes: T1 mode and CT1 mode:
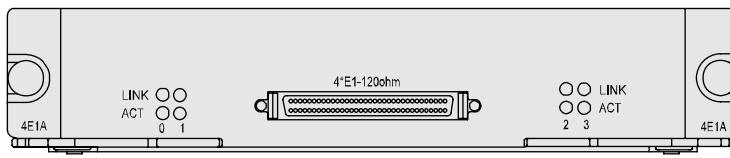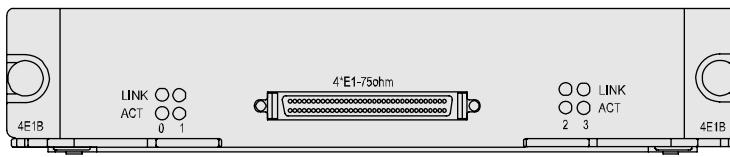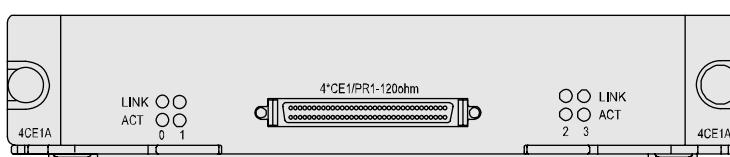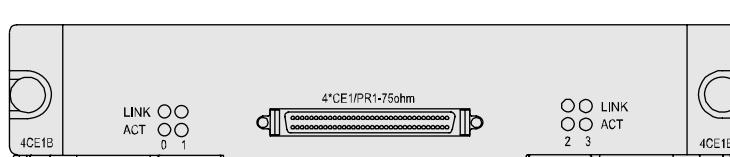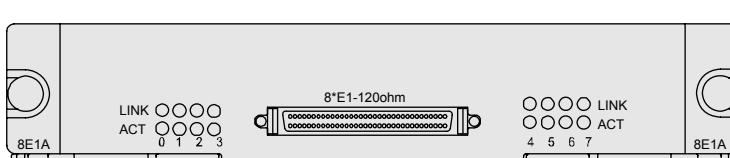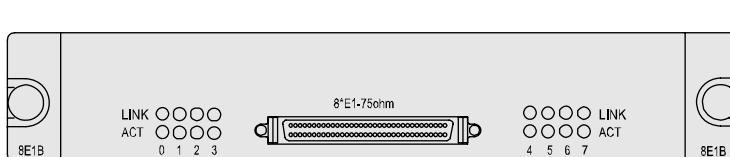
- In T1 mode, channels can be bound only once; that is, channels can be bound into one group with a speed of 1544 kbit/s.

- In CT1 mode, the 24 channels can be regrouped as required and can be bound multiple times.

## 4.7.2 Front panel

Table 4-26 shows the appearance of the channelized and unchannelized E1 interface modules. Table 4-27 shows the appearance of the channelized T1 interface modules.

**Table 4-26** Description of the channelized and unchannelized E1 interface modules

| Silkscreen | Appearance of the front panel |
|------------|-------------------------------|
| 4E1A |  |
| 4E1B |  |
| 4CE1A |  |
| 4CE1B |  |
| 8E1A |  |
| 8E1B |  |

| Silkscreen | Appearance of the front panel |
|---|---|
| 8CE1A |  |
| 8CE1B |  |
| RT-HIC-16CE1 |  |
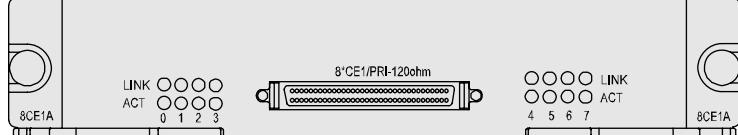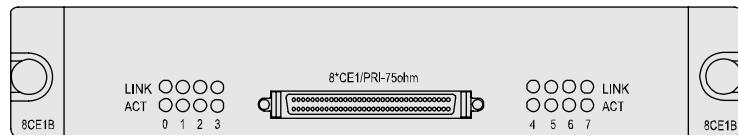
**Table 4-27** Description of the channelized T1 interface modules
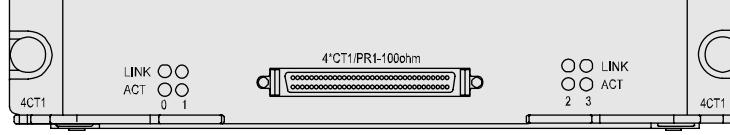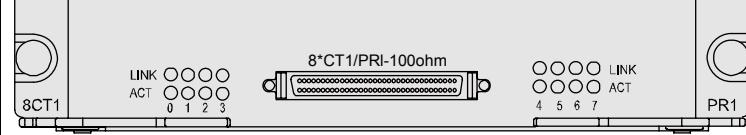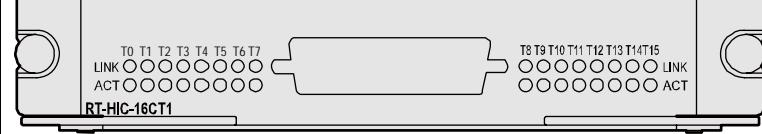
| Silkscreen | Appearance of the Front Panel |
|---|---|
| 4CT1 |  |
| 8CT1 |  |
| RTP-HIC-16CT1 |  |

Table 4-28 describes the indicators of channelized and unchannelized E1/T1 interface modules.

**Table 4-28** Description of the indicators of channelized and unchannelized E1/T1 interface modules

| Indicator | State and significance |
|-----------|------------------------|
| LINK | If the indicator is ON, the link is connected. If the indicator is OFF, the link is disconnected. |
| ACT | If the indicator is OFF, no data is being transmitted or received. If the indicator is flashing, data is being transmitted or received. |
| 0–3 (4E1/T1) | The indicators corresponding to the relevant port number. |
| 0–7 (8E1/T1) | |
| E0–E15 (16E1/T1) | |

## 4.7.3 Interface attributes

Table 4-29 shows the attributes of the channelized and unchannelized E1/T1 interface module.

**Table 4-29** Attributes of the channelized and unchannelized E1/T1 interface modules

| Attribute | Description | | | |
|-----------|-------------|---|---|---|
| | **4/8E1** | **4/8/16CE1** | **4/8CT1** | **16CT1** |
| Connector type | • DB-68 (4/8E1,4/8CE1 and 4/8CT1) <br> • DB-78 (16CE1 and 16CT1) | | | |
| Operating mode | E1 | E1 and CE1 | T1 and CT1 | |
| Transmission rate | • In E1 mode: 2048 kbit/s <br> • In CE1 mode: N x 64 kbit/s (N = 1 to 31) | | • In T1 mode: 1544 kbit/s <br> • In CT1 mode: N x 56 kbit/s and N x 64 kbit/s (N = 1 to 24) | |
| Cable model | 75 coaxial cable <br> 120 shielded twisted pair cable | | 120 shielded twisted pair cable | |
| Maximum transmission distance | 75 coaxial cable: 0.5 km <br> 120 shielded twisted pair cable 0.15 km | | 0.15 km | |
| Interface standard | ITU-T G.703 and ITU-T G.704 | | | |
| Supported network protocol | IP | | | |
| Other supported protocols | PPP, LAPB, X.25, Frame Relay, HDLC, and MP (16CE1/16CT1 supports PPP, HDLS, and MP.) | | | |

📖 **NOTE**

When the router works in CT1 mode, the default setting is binding time slots as N x 56 kbit/s (N = 1 to 24).

# 4.8 Channelized E3 interface modules

There is one type of channelized E3 interface module: the 1-port channelized E3 module (1CE3).

## 4.8.1 Functions

The channelized E3 interface module supports channelized E3 and unchannelized E3 operation modes. In channelized operating mode, the E1 channels can be configured with time slot binding.

The channelized E3 interface module provides the following functions:

- In E3 operating mode, it transmits and processes E3 high-speed data flows and provides access to E3 data flows.
- In CE3 operating mode, it provides N x 64 kbit/s (N = 1 to 31) low-speed access services.

📖 **NOTE**

E3 means the thrice primary rate (34.368 Mbit/s) of E series in the time division multiplexing system. One E3 channel can be channelized into 16 E1s. Each E1 supports both E1 and CE1 operating modes.

## 4.8.2 Front panel

Table 4-30 shows the appearance of the channelized E3 interface module.

**Table 4-30** Description of the channelized E3 interface module

| Name | Appearance of the Front Panel |
|------|-------------------------------|
| 1CE3 |  |

Table 4-31 describes the indicators of the channelized E3 interface module.

**Table 4-31** Description of the indicators of the channelized E3 interface module

| LED | Description |
|------|-------------|
| LINK | OFF means the link is not connected and ON means the link is connected. |
| ACT | OFF means no data is being transmitted or received on the interface and blinking means data is being transmitted or received. |

## 4.8.3 Interface attributes

Table 4-32 shows the attributes of the channelized E3 interface module.

**Table 4-32** Attributes of the channelized E3 interface module

| Attribute | Description |
|---|---|
| | **1CE3** |
| Connector type | SMB |
| Cable type | 75-ohm coaxial cable |
| Operating mode | E3, CE3, and CE1 |
| Interface rate | • E3 mode: 34.368 Mbit/s <br> • CE3 mode: 16 E1 channels with a rate of 2.048 Mbit/s per E1 channel <br> • CE1 mode: N x 64 kbit/s (N = 1 to 31) |
| Max. transmit distance | 0.1 km |
| Interface standard | ITU-T G.703 and G.704 |
| Supported network protocol | IP |
| Other supported protocols | PPP, MP, Frame Relay, Multiple Frame Relay (MFR), and HDLC |

# 4.9 Synchronous serial port module

There is one type of synchronous serial interface module for the Secure Router 8012: the 4-port enhanced high-speed synchronous serial interface card (4SAE).

## 4.9.1 Functions

The 4SAE supports the synchronous working mode. Its main function is to receive, send, and process the synchronous serial data flow and to support the modes of Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE).

The functions of the interface are as follows:

- supports local loopback
- automatically identifies the V.35 and V.24 cables
- supports various link layer protocols, such as PPP, Frame Relay, and HDLC

## DTE and DCE

Generally, the 4SAE card is connected with a modem and serves as a dialing port. In this case, you need to set the appropriate baud rate.

The synchronous serial port can work in either DTE mode or DCE mode. For two directly connected devices, one device works in DTE mode and the other works in DCE mode . In this case, the DCE device offers the synchronous clock and specifies the baud rate, while the DTE device receives the synchronous clock and performs communication based on the specified baud rate.

The router usually serves as a DTE device. For the type (DCE or DTE) of the device connected with the router, refer to the manual accompanying the device.

Table 4-33 describes the specified device types.

**Table 4-33** Typical DTE and DCE devices

| Device type | Interface type | Typical device |
|---|---|---|
| DTE | Pin (male) | PC and router |
| DCE | Hole (female) | Modem, multiplexer, and Channel Service Unit/Data Service Unit (CSU/DSU) |

## Synchronous interface rate and transmission distance

In different working modes, the synchronous serial port supports different electric signal standards and baud rates. The configured baud rate and the selected cable determine the maximum transmission distance of the signal. For the relationship between cable type, baud rate, and maximum transmission distance of signals, see Table 4-34.

⚠ **CAUTION**

If the V.24 cable is used, the serial interface baud rate cannot exceed 64 kbit/s.

**Table 4-34** V.24/V.35 cable rate and transmission distance

| V.24 | | V.35 | |
|---|---|---|---|
| Baud rate | Maximum transmission distance | Baud rate | Maximum transmission distance |
| 2400 bit/s | 60 m | 2400 bit/s | 1250 m |
| 4800 bit/s | 60 m | 4800 bit/s | 625 m |
| 9600 bit/s | 30 m | 9600 bit/s | 312 m |
| 19200 bit/s | 30 m | 19 200 bit/s | 156 m |

| V.24 | | V.35 | |
|---|---|---|---|
| 38400 bit/s | 20 m | 38 400 bit/s | 78 m |
| 64000 bit/s | 20 m | 56 000 bit/s | 60 m |
| 115200 bit/s | 10 m | 64 000 bit/s | 50 m |
| — | — | 2 048 000 bit/s | 30 m |

## 4.9.2 Front panel

Table 4-35 shows the appearance of the synchronous serial port module.

**Table 4-35** Description of the synchronous serial port module

| Silkscrern | Appearance of the front panel |
|---|---|
| 4SAE |  |

Table 4-36 describes the indicators of a synchronous serial port module.

**Table 4-36** Description of the indicators of a synchronous serial port module

| Indicator | State and Significance |
|---|---|
| LINK | If the indicator is ON, the link is connected. If the indicator is OFF, the link is disconnected. |
| ACT | If the indicator is OFF, no data is being transmitted or received. If the indicator is flashing, data is being transmitted or received. |

## 4.9.3 Interface attributes

Table 4-37 shows the attributes of the synchronous serial port.

**Table 4-37** Attributes of the 4SAE interface module

| Attribute | Description | |
|---|---|---|
| Connector type | DB-28 | |
| Interface standard and working mode | V.24 | V.35 |
| | DTE and DCE | DTE |

| Attribute | Description | |
|---|---|---|
| | | DCE |
| Minimum baud rate | 1200 bit/s | 1200 bit/s |
| Maximum baud rate | 64 kbit/s | 2.048 Mbit/s |
| Cable type | V.24 DTE cable V.24 DCE cable V.35 DTE cable V.35 DCE cable | |
| Supported protocol | PPP, HDLC, Frame Relay, MFR, and MP | |

# 4.10 Channelized and unchannelized POS optical interface modules

The channelized and unchannelized POS optical interface modules of the Secure Router 8012 are as follows:

- FIC
  - 1-port channelized POS optical module (1CPOS[E])
- HIC
  - 1-port unchannelized POS/155M optical interface module (RT-HIC-1POS)
  - 2-port unchannelized POS/155M optical interface module (RT-HIC-2POS)
  - 4-port unchannelized POS/155M optical interface module (RT-HIC-4POS)
  - 1-port channelized POS optical interface E1 module (RT-HIC-CPE1)
  - 1-port channelized POS optical interface T1 module (RT-HIC-CPT1)

## 4.10.1 Functions

The Packet over SDH/SONET (POS) interface is a high-speed transport interface that uses the SONET/SDH network as the transport interface. In the sending direction, the POS interface encapsulates IP data packets received from the Network Process Unit (NPU) with the PPP or HDLC protocol, and then maps the encapsulated data packets to the payload of the SONET/SDH frame for transmission on the optical network. In the receiving direction, the POS interface receives optical signals, processes them through reverse operations, and then sends them to the NP.

The POS interface board can be used to connect Secure Router 8012 routers to SONET/SDH devices, or to connect Secure Router 8012 routers directly.

One POS interface module can be channelized into 63 E1 channels, or 84 T1 channels.

The functions of interface are as follows:

- supports hardware flow control and software resetting
- supports various link layer protocols, such as PPP, Frame Relay, and HDLC
- supports the working modes of FPGA loopback, the system-side loopback of the physical chip, and the line-side loopback

## 4.10.2 Front panel

Table 4-38 shows the appearance of channelized and unchannelized POS optical interface modules.

**Table 4-38** Description of channelized and unchannelized POS optical interface modules
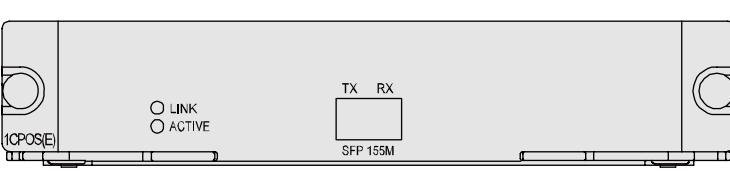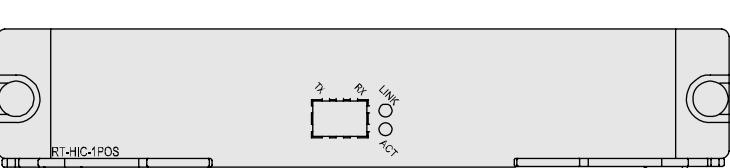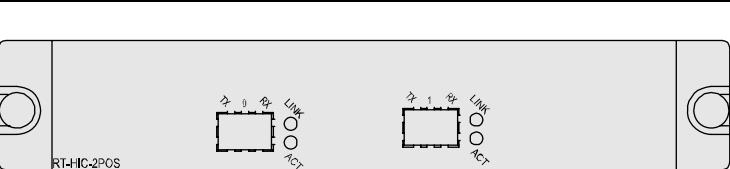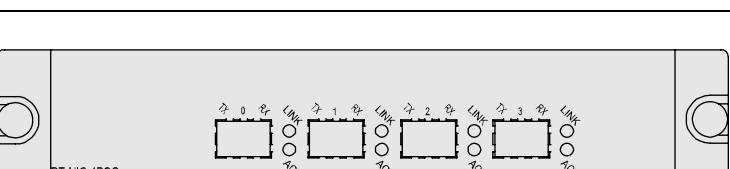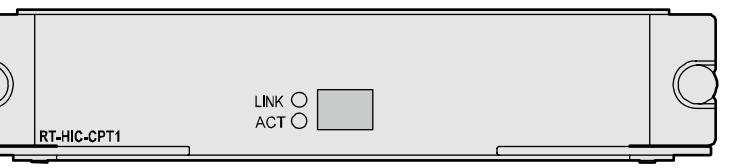
| Silkscreen | Appearance of the front panel |
|---|---|
| 1CPOS(E) | LINK / ACTIVE / TX RX / 1CPOS(E) / SFP 155M |
| RT-HIC-1POS | TX RX LINK ACT / RT-HIC-1POS |
| RT-HIC-2POS | TX 0 RX LINK ACT / TX 1 RX LINK ACT / RT-HIC-2POS |
| RT-HIC-4POS | TX 0 RX LINK ACT / TX 1 RX LINK ACT / TX 2 RX LINK ACT / TX 3 RX LINK ACT / RT-HIC-4POS |
| RT-HIC-CPE1 | LINK / ACT / RT-HIC-CPE1 |
| RT-HIC-CPT1 | LINK / ACT / RT-HIC-CPT1 |

Table 4-39 describes the indicators of channelized and unchannelized POS optical interface modules.

**Table 4-39** Description of the indicators on the front panel of POS optical interface modules

| Indicator | State and Significance |
|-----------|----------------------|
| LINK | If the indicator is ON, the link is connected. If the indicator is OFF, the link is disconnected. |
| ACT | If the indicator is OFF, no data is being transmitted or received. If the indicator is flashing, data is being transmitted or received. |

# 4.10.3 Interface attributes

Table 4-40 shows the attributes of channelized and unchannelized POS optical interface modules. The SFP optical module is configured separately and its attributes are shown in Table 4-20.

**Table 4-40** Attributes of channelized and unchannelized POS optical interface modules

| Item | Description |
|------|-------------|
| Rate | 155 Mbit/s |
| Operating mode | Unchannelized: 155 Mbit/s and full-duplex<br>Channelized: 63 E1 channels or 84 T1 channels |
| Applicable standard | STM-1/OC-3c SONET/SDH<br>IETF RFC1619/1661/1662 |
| Supported network protocol | IP |
| Supported protocols | PPP, HDLC, Frame Relay, and MFR (Only 1CPOS(E) supports Frame Relay and MFR.) |

# 4.11 HSSI interface module

The HSSI interface modules of the Secure Router 8012 are as follows:

- 1-port HSSI interface (1HSSI)

- 2-port HSSI interface (2HSSI)

## 4.11.1 Functions

The High Speed Serial Interface (HSSI) is connected by the HSSI cable. In the sending direction, the IP data packet is encapsulated with PPP or HDLC and sent to the HSSI interface line after being transmitted into electrical signals. In the receiving direction, data is transmitted into the electrical signals and is processed with the HDLC frame. The device extracts the IP data packet in the reverse process and forward the IP data packet.

The Secure Router 8012 with HSSI can be connected to the DCE equipment (CSU/DSU) as the DTE equipment, or it can be connected with the DTE equipment back-to-back.

The functions of interface are as follows:

- The HSSI interface level is ECL. The highest rate is 52 Mbit/s and the maximum transmission distance is 50 inches (15 m).
- HSSI supports two loop working modes: the physical chip self-loop and the line self-loop.
- The interface supports many link layer protocols, such as PPP and HDLC.
- The interface supports auto-identification of DTE and DCE and chooses the clock automatically.

## 4.11.2 Front panel

Table 4-41 shows the appearance of the HSSI interface module.

**Table 4-41** Description of the HSSI front panel

| Silkscreen | Appearance of the front panel |
|------------|-------------------------------|
| 1HSSI |  |
| 2HSSI |  |

Table 4-42 describes the indicators of the HSSI interface module.

**Table 4-42** Description of the indicators of the HSSI front panel

| Indicator | State and significance |
|-----------|------------------------|
| LINK | If the indicator is ON, the link is connected. If the indicator is OFF, the link is disconnected. |
| ACT | If the indicator is OFF, no data is being transmitted or received. If the indicator is flashing, data is being transmitted or received. |

## 4.11.3 Interface attributes

Table 4-43 shows the attributes of the HSSI interface module.

**Table 4-43** Attributes of the HSSI interface module

| Item | Description |
|------|-------------|
| Type | HSSI electrical interface |
| Rate | 52 Mbit/s |
| Working mode | Unchannelized: 51.84M |
| Standard compliance | Compliant with STS-1 |
| Supported network protocol | IP |
| Supported link layer protocols | PPP<br>HDLC |

# 4.12 IPSec encryption HIC module

## 4.12.1 Function

The encryption HIC module supports IPSec. It speeds up IP packet encryption through hardware processing, providing the router with high-performance, reliable encryption.

## 4.12.2 Front panel

Table 4-44 shows the front panel of an IPSec encryption HIC module.

**Table 4-44** Front panel of an IPSec encryption HIC module

| Silkscreen | Appearance |
|------------|------------|
| RT-HIC-HPSEC |  |

Table 4-45 describes the indicators of an IPSec encryption HIC module.

**Table 4-45** Description of the indicators of an IPSec encryption HIC module

| Indicator | State and significance |
|-----------|------------------------|
| LINK | If the indicator is OFF, the link is disconnected. If the indicator is ON, the link is connected. |
| ACT | If the indicator is OFF, no data is being transmitted or received. If the |

| | indicator flashes, data is being transmitted or received. |
| --- | --- |

## 4.12.3 Module attributes

Table 4-46 shows the attributes of the IPSec encryption HIC module.

**Table 4-46** Attributes of the IPSec encryption HIC module

| Item | Description |
| --- | --- |
| Supported protocol | IPSec/IKE |
| Supported maximum concurrent IPSec connections | • Site-to-Site: 5000<br>• Virtual Private Dial-up Network (VPDN): 12 000 |
| Hardware algorithm | Encryption algorithms: DES, 3DES, AES128, AES192, and AES256<br>Encryption mode: CBC |

# Contents

# Figures

# Tables

# 5 Cables

# About this chapter

The following table shows the contents of this chapter.

| Title | Description |
|---|---|
| 5.1 DC power cable | This section describes the structure of a DC power cable. |
| 5.2 AC power cable | This section describes the structure of an AC power cable. |
| 5.3 Console port cable | This section describes the structure of the console communication cable. |
| 5.4 Auxiliary port communication cable | This section describes the structure of the AUX communication cable. |
| 5.5 Ethernet cable | This section describes the structure of the Ethernet cable. |
| 5.6 Optical fiber | This section describes the optical fiber and connector. |
| 5.7 Channelized and unchannelized E1/T1 interface cable | This section describes the structure and model of the channelized and unchannelized E1/T1 interface cable. |
| 5.8 Channelized E3 interface cable | This section describes the structure of the channelized E3 interface cable. |
| 5.9 Synchronous serial interface cable | This section describes the structure of the synchronous serial interface cable. |
| 5.10 HSSI cable | This section describes the structure and category of the High Speed Serial Interface (HSSI) cable. |

# 5.1 DC power cable

## 5.1.1 Introduction

The Direct Current (DC) power input range is from –36 V DC to –72 V DC.

The DC power cable contains the –48 V power cable NEG (–) and the ground (GND) power cable RTN (+).The power cable transfers the –48 V DC power from the DC distribution equipment to the terminal block of the Secure Router 8012 power module, supplying power for the Secure Router 8012 equipment.

## 5.1.2 Structure

The wiring terminal of the Secure Router 8012 power module is the OT bare pressure terminal. Figure 5-1 shows the outline of the DC power cable.

**Figure 5-1** DC power cable

| W | Electronic and electrical cable-600 V-10 A WG-blue round-OEM dedicated |
|---|---|
| X1 | Bare pressed OT terminal-6 mm^2-M4-tin electroplating-round preinsulated terminal-12 to 10 A WG-yellow |
| X2 | Ordinary terminal-single core cold pressed terminal-6mm^2-0.02 m-30A-inserting depth 12 mm-black |
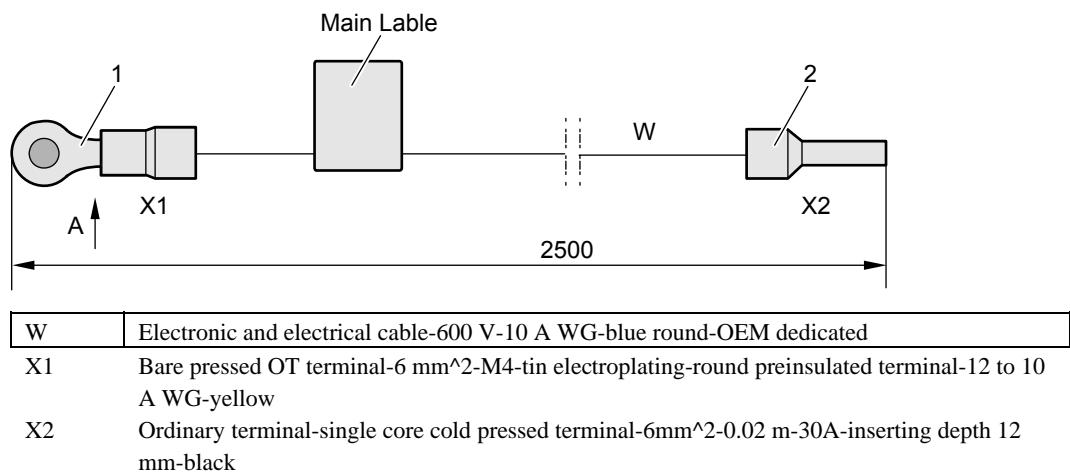
# 5.2 AC power cable

## 5.2.1 Introduction

The Alternating Current (AC) power cable ranges from 85 V AC to 264 V AC and 50/60 Hz.

The power cable transmits the AC to the terminal block of the Secure Router 8012 power module to supply power to the entire Secure Router 8012.

Nortel recommends that you use the grounding single-phase three-line power supply. The grounding point of the power supply in the building must be reliable grounding. The power grounding cable of the power supplying system is buried in the ground during the construction of the building. You must ensure that the power supplies are grounded before you connect the AC power cable of the Secure Router 8012 routers.

## 5.2.2 Structure

The Secure Router 8012 AC power cable includes the local-standard cable for Europe, North America, and the United Kingdom, as well as the Chinese standard AC power cable.

# 5.3 Console port cable

## 5.3.1 Introduction

The console cable connects the Secure Router 8012 console port to the serial port of the console device for transmitting equipment configuration data.

The console cable is an 8-core shielded cable. One end uses the RJ45 connector that is connected to the console port of the Routing Process Unit (RPU). The other end has two connectors with DB9 (female) and DB25 (female), and is connected to the serial port of the computer. You can use either of them to connect the computer serial port as required.

## 5.3.2 Structure

Figure 5-2 shows the console port cable.

**Figure 5-2** Console port cable
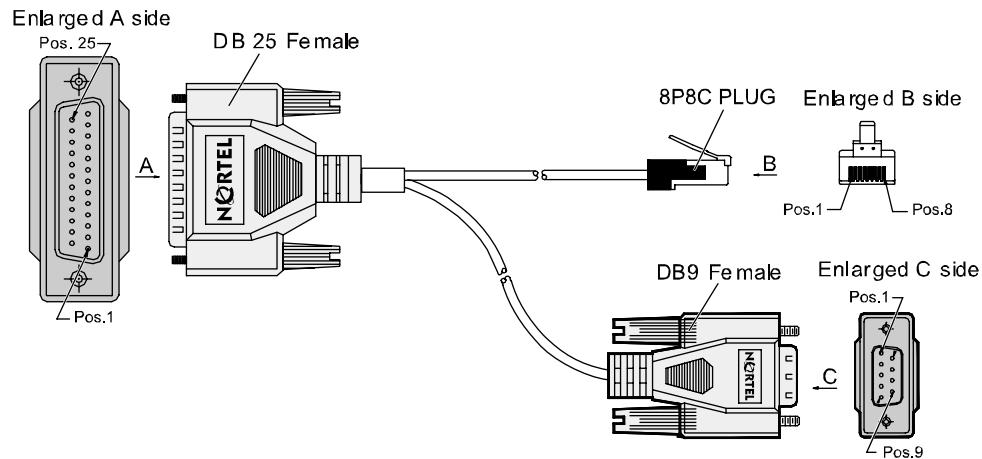


Table 5-1 shows the pin assignment of the console port cables.

**Table 5-1** Pin assignment of console cables

| RJ45 | Signal Direction | DB25 | DB9 | Signal |
|------|------------------|------|-----|--------|
| 1 | → | 5 | 8 | CTS(Clear to Send) |
| 2 | → | 6 | 6 | DSR(Data Set Ready) |
| 3 | → | 3 | 2 | RXD(Receive Data) |

| RJ45 | Signal Direction | DB25 | DB9 | Signal |
|------|------------------|------|-----|--------|
| 4 | - | 7 | 5 | GND |
| 5 | - | 8 | 1 | GND |
| 6 | ← | 2 | 3 | TXD(Transmit Data) |
| 7 | ← | 20 | 4 | DTR(Data Terminal Ready) |
| 8 | ← | 4 | 7 | RTS(Request to Send) |

# 5.4 Auxiliary port communication cable

## 5.4.1 Introduction

The auxiliary (AUX) port cable connects the Secure Router 8012 AUX port to the modem for remote transmission of configuration data.

The AUX port cable is an 8-core shielded cable. One end uses the RJ45 connector that is connected to the AUX port of the Routing Process Unit (RPU). The other end has two connectors with DB9 (female) and DB25 (female), and is connected to the computer serial port. You can use either of them to connect the computer serial port as required.

## 5.4.2 Structure

The structure of the AUX cable is the same as that of the console cable, as shown in Figure 5-2. Table 5-2 shows the pin assignment of the AUX cables.

**Table 5-2** Pin assignment of AUX cables

| RJ45 | Signal direction | DB25 | DB9 | Signal |
|------|------------------|------|-----|--------|
| 1 | → | 4 | 7 | RTS |
| 2 | → | 20 | 4 | DTR |
| 3 | → | 2 | 3 | TXD |
| 4 | ← | 8 | 1 | DCD |
| 5 | - | 7 | 5 | GND |
| 6 | ← | 3 | 2 | RXD |
| 7 | ← | 6 | 6 | DSR |
| 8 | ← | 5 | 8 | CTS |

# 5.5 Ethernet cable

## 5.5.1 Introduction

The Ethernet cable consists of two types: straight-through cable and crossover cable.

### Straight-through cable

Straight through cable is also called standard cable. The wire sequences of the twisted pairs crimped in the RJ45 connectors at both ends are the same. Straight-through cable connects a terminal device (a PC or the router) to a hub or a LAN switch. The cables delivered with the equipment are straight-through cables.

### Crossover cable

Crossover cable is also called direct connection cable. The wire sequences of the twisted pairs crimped in the RJ45 connectors at both ends are different. Crossover cable connects two terminal devices (a PC or the router).

## 5.5.2 Structure

Both straight-through cable and crossover cable use shield cables and RJ45 connectors. Figure 5-3 and Figure 5-4 show the pin assignment.

**Figure 5-3** Schematic diagram of straight-through cable

```
RJ45                      RJ45
  1  ——————————  1
  2  ——————————  2

  3  ——————————  3
  6  ——————————  6
```
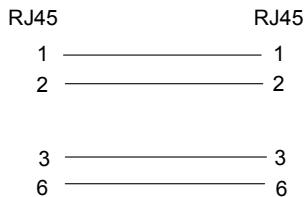
**Figure 5-4** Schematic diagram of crossover cable

```
RJ45                      RJ45
  1  ———         ———  1
  2  ———  \   /  ———  2
           \ /
           / \
  3  ———  /   \  ———  3
  6  ———         ———  6
```
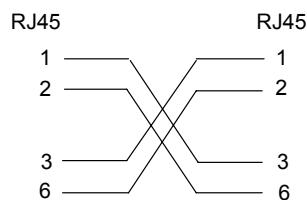
Table 5-3 and Table 5-4 describe the pin assignment of straight-through cable and crossover cable.

**Table 5-3** Pin assignment of straight-through cable

| RJ45 | Signal | Category 5 Twisted Pair | Signal Direction | RJ45 |
|------|--------|-------------------------|------------------|------|
| 1 | TX+ | White (Orange) | → | 1 |
| 2 | TX- | Orange | → | 2 |
| 3 | RX+ | White (Green) | ← | 3 |
| 4 | - | Blue | - | 4 |
| 5 | - | White (Blue) | - | 5 |
| 6 | RX- | Green | ← | 6 |
| 7 | - | White (Brown) | - | 7 |
| 8 | - | Brown | - | 8 |

**Table 5-4** Pin assignment of crossover cable

| RJ45 | Signal | Category 5 Twisted Pair | Signal Direction | RJ45 |
|------|--------|-------------------------|------------------|------|
| 1 | TX+ | White (Green) | → | 3 |
| 2 | TX- | Green | → | 6 |
| 3 | RX+ | White (Orange) | ← | 1 |
| 4 | - | Blue | - | 4 |
| 5 | - | White (Blue) | - | 5 |
| 6 | RX- | Orange | ← | 2 |
| 7 | - | White (Brown) | - | 7 |
| 8 | - | Brown | - | 8 |

**📖 NOTE**

Refer to the previous table to differentiate and produce two Ethernet cables. If you do not arrange the line order according to this chromatogram, the communication quality can be affected although the two ends are connected.

# 5.6 Optical fiber

## 5.6.1 Introduction

The Secure Router 8012 uses the optical module on different optical interfaces. Table 5-5 shows the corresponding optical fiber.

**Table 5-5** Relationship between the interface type and corresponding optical fiber

| Interface type | Fiber transmission mode | Optical connectors | Transmission Distance |
|---|---|---|---|
| FIC ATM 155M optical interface | Single-mode/multi-mode | SC/PC | 5 m, 10 m, and 20 m |
| HIC ATM 155M optical interface | Single-mode/multi-mode | LC/PC | 5 m, 10 m, and 20 m |
| Ethernet optical interface | Single-mode/multi-mode | LC/PC | 5 m, 10 m, and 20 m |
| Gigabit Ethernet interface | Single-mode/multi-mode | LC/PC | 5 m, 10 m, and 20 m |
| POS optical interface | Single-mode/multi-mode | LC/PC | 5 m, 10 m, and 20 m |

SFP is the plug-in type. You can plug both multi-mode modules and single-mode modules into the interface board. Different optical modules and optical connectors require different fiber. The multi-mode interface module connects with the multi-mode fiber; the single-mode module connects with the single–mode fiber.

The interfaces of FIC low-speed ATM 155M optical modules are equipped with a Square Connector (SC) optical connector as shown in Figure 5-5. Therefore, Nortel recommends that you use the fiber with SC/PC optical connectors. In addition, the optical interfaces of 100Base-FX Ethernet optical interface module, Gigabit Ethernet optical interface module, the HIC high-speed ATM 155M optical interface module and POS optical interface module should use the Lucent Connector (LC) optical connector as shown in Figure 5-6. Therefore, Nortel recommends that you use the fiber with LC/PC optical connectors.

## 5.6.2 Optical connector

The Secure Router 8012 uses two types of optical connectors:

- SC/PC optical connector
- LC/PC optical connector

The following sections describe their outlines, operations, and precautions for plugging in and unplugging the connectors.

Figure 5-5 shows the outline of the SC/PC optical connectors.

**Figure 5-5** SC/PC optical connector
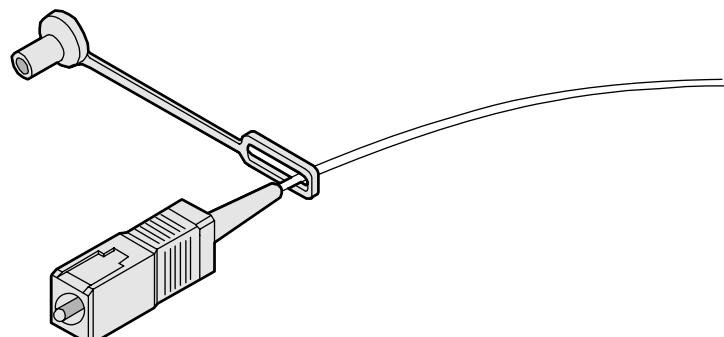


Figure 5-6 shows the outline of the LC/PC optical connectors.

**Figure 5-6** LC/PC optical connector
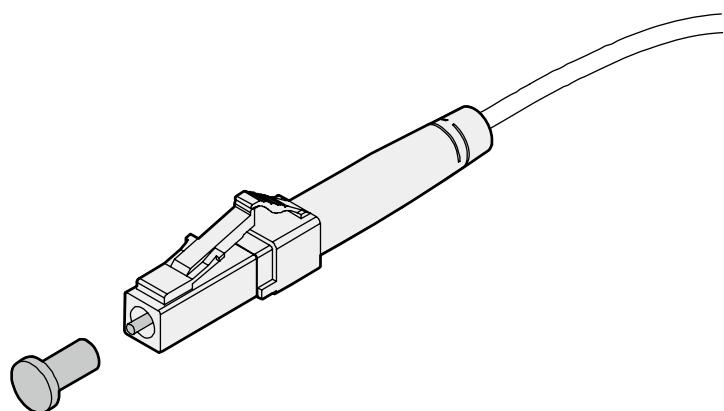


When you plug in or unplug LC/PC and SC/PC optical connectors, you do not need to rotate them... The operation procedures and precautions are as follows:

- When plugging in the fiber connector, be careful to align the fiber head with the optical interface, and push in the fiber with proper force.

- When pulling the fiber out, press the clip first, and then pull the fiber connector slightly and unplug the connector.

# 5.7 Channelized and unchannelized E1/T1 interface cable

## 5.7.1 4E1/4CE1 interface cable

The Secure Router 8012 provides two types of 4-port interface cables as shown in Figure 5-7 and Figure 5-8. They are the 4-port E1/CE1 coaxial cable and 4-port E1/CE1 shielded twisted-pair cable. E1 cable and CE1 cable are compatible.

**Figure 5-7** The 75-ohm 4E1/4CE1 coaxial cable
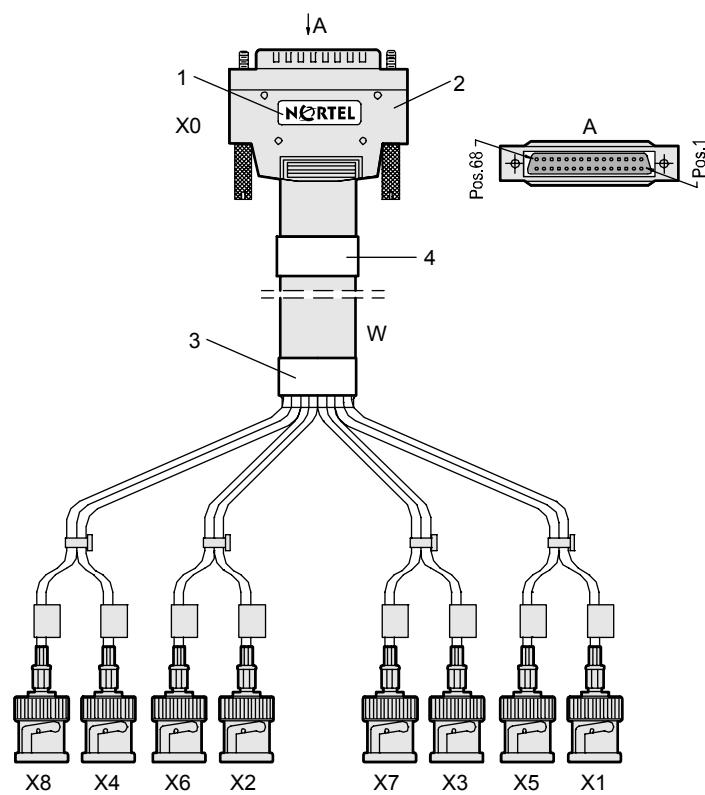
**Figure 5-8** The 120-ohm   4E1/4CE1 shielded twisted-pair cable
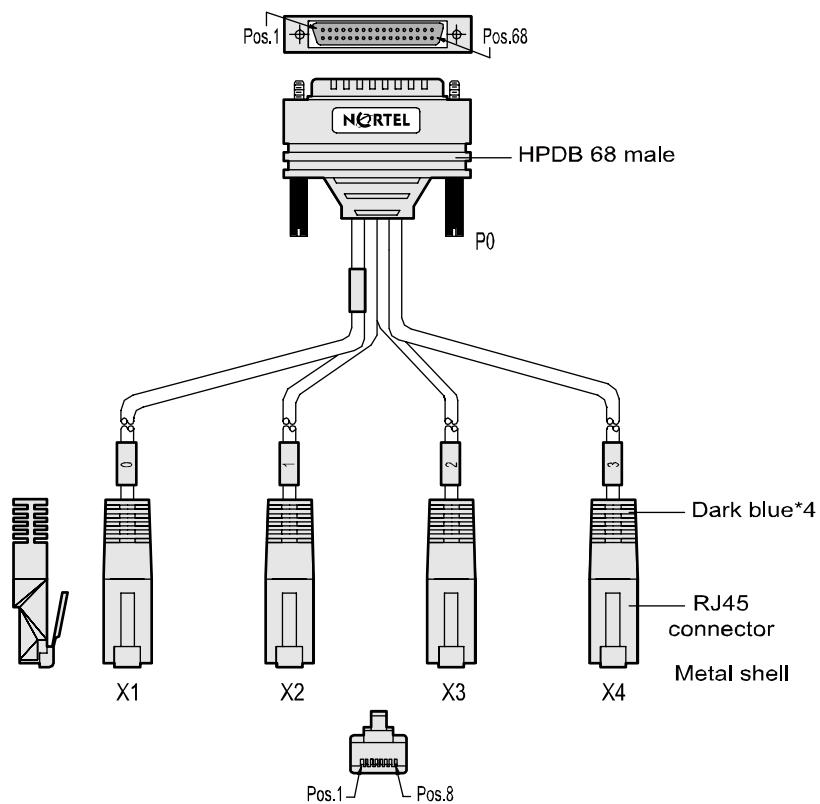


Table 5-6 and Table 5-7 show the pin assignment of 4E1/4CE1 coaxial and twisted-pair cables.

**Table 5-6** Pin assignment of 4E1/4CE1 coaxial cable

| DB68 | Signal | Direction | BNC |
|---|---|---|---|
| 1 | AGND | — | — |
| 2 | AGND | — | — |
| 3 | TxTip3 | → | No. 3 transmission |
| 4 | TxRing3 | → | No. 3 transmission |
| 5 | AGND | — | — |
| 6 | AGND | — | — |
| 10 | — | — | — |
| 11 | TxTip2 | → | No. 2 transmission |
| 12 | TxRing2 | → | No. 2 transmission |
| 13 | AGND | — | — |
| 14 | AGND | — | — |

| DB68 | Signal | Direction | BNC |
|------|--------|-----------|-----|
| 19 | TxTip1 | → | No. 1 transmission |
| 20 | TxRing1 | → | No. 1 transmission |
| 21 | AGND | — | — |
| 22 | AGND | — | — |
| 27 | TxTip0 | → | No. 1 transmission |
| 28 | TxRing0 | → | No. 1 transmission |
| 29 | AGND | — | — |
| 30 | AGND | — | — |
| 35 | AGND | — | — |
| 36 | RxShield3 | — | — |
| 37 | RxTip3 | ← | No. 3 reception |
| 38 | RxRing3 | ← | No. 3 reception |
| 43 | AGND | — | — |
| 44 | RxShield2 | — | — |
| 45 | RxTip2 | ← | No. 2 reception |
| 46 | RxRing2 | ← | No. 2 reception |
| 51 | AGND | — | — |
| 52 | RxShield1 | — | — |
| 53 | RxTip1 | ← | No. 1 reception |
| 54 | RxRing1 | ← | No. 1 reception |
| 55 | AGND | — | — |
| 59 | AGND | — | — |
| 60 | RxShield0 | — | — |
| 61 | RxTip0 | ← | No. 0 reception |
| 62 | RxRing0 | ← | No. 0 reception |
| 67 | AGND | — | — |
| 68 | AGND | — | — |

**Table 5-7** Pin assignment of 4E1/4CE1 shielded twisted-pair cable

| DB68 | Signal | Direction | Signal | RJ45 |
|------|--------|-----------|--------|------|
| 1 | AGND | — | — | — |
| 2 | AGND | — | — | — |
| 3 | TxTip3 | → | RxTip3 | 4 |
| 4 | TxRing3 | → | RxRing3 | 5 |
| 36 | RxShield3 | ← | TxShield3 | 3 |
| 37 | RxTip3 | ← | TxTip3 | 1 |
| 38 | RxRing3 | ← | TxRing3 | 2 |
| 7 | TxShield3 | → | RxShield3 | 6 |
| 5 | AGND | — | — | — |
| 6 | AGND | — | — | — |
| 11 | TxTip2 | → | RxTip2 | 4 |
| 12 | TxRing2 | → | RxRing2 | 5 |
| 44 | RxShield2 | ← | TxShield2 | 3 |
| 45 | RxTip2 | ← | TxTip2 | 1 |
| 46 | RxRing2 | ← | TxRing2 | 2 |
| 15 | TxShield2 | → | RxShield2 | 6 |
| 13 | AGND | — | — | — |
| 14 | AGND | — | — | — |
| 19 | TxTip1 | → | RxTip1 | 4 |
| 20 | TxRing1 | → | RxRing1 | 5 |
| 52 | RxShield1 | ← | TxShield1 | 3 |
| 53 | RxTip1 | ← | TxTip1 | 1 |
| 54 | RxRing1 | ← | TxRing1 | 2 |
| 23 | TxShield1 | → | RxShield1 | 6 |
| 21 | AGND | — | — | — |
| 22 | AGND | — | — | — |
| 26 | TxShield0 | → | RxShield0 | 6 |
| 27 | TxTip0 | → | RxTip0 | 4 |
| 28 | TxRing0 | → | RxRing0 | 5 |
| 60 | RxShield0 | ← | TxShield0 | 3 |

| DB68 | Signal | Direction | Signal | RJ45 |
|------|--------|-----------|--------|------|
| 61 | RxTip0 | ← | TxTip0 | 1 |
| 62 | RxRing0 | ← | TxRing0 | 2 |
| 30 | AGND | — | — | — |
| 35 | AGND | — | — | — |
| 43 | AGND | — | — | — |
| 51 | AGND | — | — | — |
| 59 | AGND | — | — | — |
| 67 | AGND | — | — | — |
| 68 | AGND | — | — | — |

## 5.7.2 8E1/8CE1 interface cable

The Secure Router 8012 provides two types of 8-port interface cables as shown in Figure 5-9 and Figure 5-10. They are the 8-port E1/CE1 coaxial cable and the 8-port E1/CE1 shielded twisted-pair cable. E1 and CE1 cable are compatible.

**Figure 5-9** 75-ohm 8E1/8CE1 coaxial cable
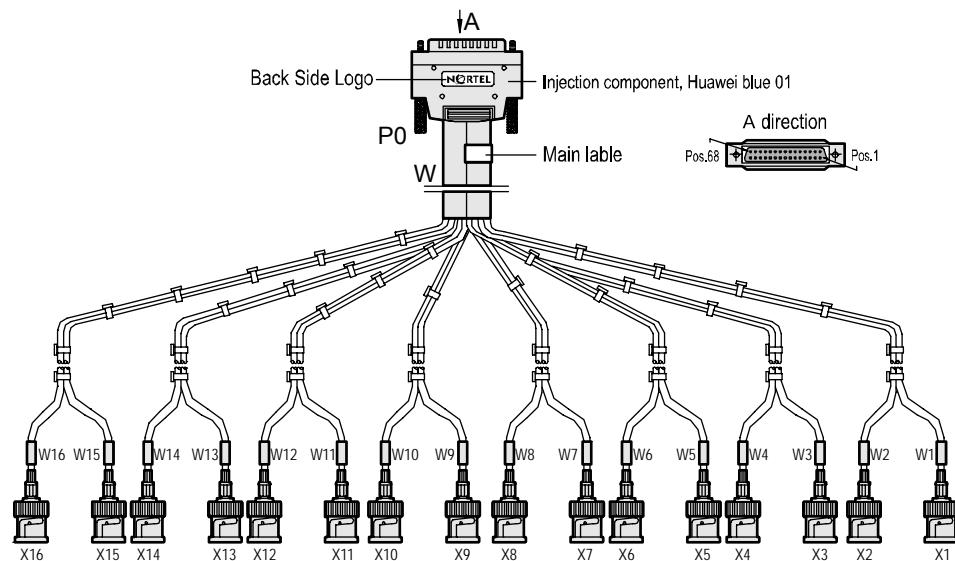
**Figure 5-10** 120-ohm 8E1/8CE1 shielded twisted-pair cable
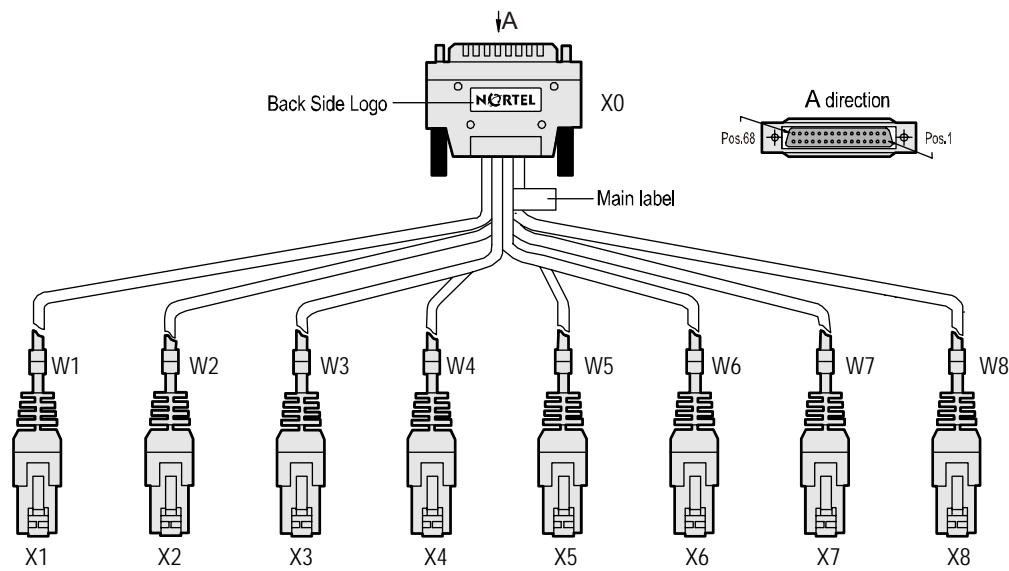


Table 5-8 and Table 5-9 show the pin assignment of 8E1/8CE1 coaxial and twisted-pair cables.

**Table 5-8** Pin assignment of 8E1/8CE1 coaxial cable

| DB68 | Signal | Direction | Signal | BNC |
|------|--------|-----------|--------|-----|
| 1 | DGND | — | — | — |
| 2 | DGND | — | — | — |
| 47 | CAB_ID0 | — | — | — |
| 55 | CAB_ID1 | → PIN68 | DGND | — |
| 63 | CAB_ID2 | → PIN67 | DGND | — |
| 3 | TxTip3 | → | TxTip3 | No.3 transmission |
| 4 | TxRing3 | → | TxRing3 | No.3 transmission |
| 37 | RxTip3 | ← | RxTip3 | No.3 reception |
| 38 | RxRing3 | ← | RxRing3 | No.3 reception |
| 5 | PGND | — | — | — |
| 6 | PGND | — | — | — |
| 11 | TxTip2 | → | TxTip2 | No.2 transmission |
| 12 | TxRing2 | → | TxRing2 | No.2 transmission |
| 45 | RxTip2 | ← | RxTip2 | No.2 reception |
| 46 | RxRing2 | ← | RxRing2 | No.2 reception |
| 13 | PGND | — | — | — |

| DB68 | Signal | Direction | Signal | BNC |
|------|--------|-----------|--------|-----|
| 14 | PGND | — | — | — |
| 19 | TxTip1 | → | TxTip1 | No.1 transmission |
| 20 | TxRing1 | → | TxRing1 | No.1 transmission |
| 53 | RxTip1 | ← | RxTip1 | No.1 reception |
| 54 | RxRing1 | ← | RxRing1 | No.1 reception |
| 21 | PGND | — | — | — |
| 22 | PGND | — | — | — |
| 27 | TxTip0 | → | TxTip0 | No.0 transmission |
| 28 | TxRing0 | → | TxRing0 | No.0 transmission |
| 61 | RxTip0 | ← | RxTip0 | No.0 reception |
| 62 | RxRing0 | ← | RxRing0 | No.0 reception |
| 30 | PGND | — | — | — |
| 29 | PGND | — | — | — |
| 9 | TxTip7 | → | TxTip7 | No.7 transmission |
| 10 | TxRing7 | → | TxRing7 | No.7 transmission |
| 41 | RxTip7 | ← | RxTip7 | No.7 reception |
| 42 | RxRing7 | ← | RxRing7 | No.7 reception |
| 17 | TxTip6 | → | TxTip6 | No.6 transmission |
| 18 | TxRing6 | → | TxRing6 | No.6 transmission |
| 49 | RxTip6 | ← | RxTip6 | No.6 reception |
| 50 | RxRing6 | ← | RxRing6 | No.6 reception |
| 25 | TxTip5 | → | TxTip5 | No.5 transmission |
| 26 | TxRing5 | → | TxRing5 | No.5 transmission |
| 57 | RxTip5 | ← | RxTip5 | No.5 reception |
| 58 | RxRing5 | ← | RxRing5 | No.5 reception |
| 33 | TxTip4 | → | TxTip4 | No.4 transmission |
| 34 | TxRing4 | → | TxRing4 | No.4 transmission |
| 65 | RxTip4 | ← | RxTip4 | No.4 reception |
| 66 | RxRing4 | ← | RxRing4 | No.4 reception |
| 35 | PGND | — | — | — |
| 39 | PGND | — | — | — |

| DB68 | Signal | Direction | Signal | BNC |
|------|--------|-----------|--------|-----|
| 43 | PGND | — | — | — |
| 51 | PGND | — | — | — |
| 59 | PGND | — | — | — |
| 67 | DGND | — | — | — |
| 68 | DGND | — | — | — |

**Table 5-9** Pin assignment of 8E1/8CE1/8CT1 shielded twisted-pair cable

| DB68 | Signal | Direction | Signal | RJ45 |
|------|--------|-----------|--------|------|
| 1 | DGND | — | — | — |
| 2 | DGND | — | — | — |
| 47 | CAB_ID0 | → PIN1 | DGND | — |
| 55 | CAB_ID1 | → PIN68 | DGND | — |
| 63 | CAB_ID2 | → PIN67 | DGND | — |
| 3 | TxTip3 | → | TxTip3 | 4 |
| 4 | TxRing3 | → | TxRing3 | 5 |
| 7 | TxShield3 | → | TxShield3 | 6 |
| 36 | RxShield3 | ← | RxShield3 | 3 |
| 37 | RxTip3 | ← | RxTip3 | 1 |
| 38 | RxRing3 | ← | RxRing3 | 2 |
| 5 | PGND | — | — | — |
| 6 | PGND | — | — | — |
| 11 | TxTip2 | → | TxTip2 | 4 |
| 12 | TxRing2 | → | TxRing2 | 5 |
| 15 | TxShield2 | → | TxShield2 | 6 |
| 44 | RxShield2 | ← | RxShield2 | 3 |
| 45 | RxTip2 | ← | RxTip2 | 1 |
| 46 | RxRing2 | ← | RxRing2 | 2 |
| 13 | PGND | — | — | — |
| 14 | PGND | — | — | — |
| 19 | TxTip1 | → | TxTip1 | 4 |

| DB68 | Signal | Direction | Signal | RJ45 |
|---|---|---|---|---|
| 20 | TxRing1 | → | TxRing1 | 5 |
| 23 | TxShield1 | → | TxShield1 | 6 |
| 52 | RxShield1 | ← | RxShield1 | 3 |
| 53 | RxTip1 | ← | RxTip1 | 1 |
| 54 | RxRing1 | ← | RxRing1 | 2 |
| 21 | PGND | — | — | — |
| 22 | PGND | — | — | — |
| 27 | TxTip0 | → | TxTip0 | 4 |
| 28 | TxRing0 | → | TxRing0 | 5 |
| 31 | TxShield0 | → | TxShield0 | 6 |
| 60 | RxShield0 | ← | RxShield0 | 3 |
| 61 | RxTip0 | ← | RxTip0 | 1 |
| 62 | RxRing0 | ← | RxRing0 | 2 |
| 30 | PGND | — | — | — |
| 29 | PGND | — | — | — |
| 9 | TxTip7 | → | TxTip7 | 4 |
| 10 | TxRing7 | → | TxRing7 | 5 |
| 8 | TxShield7 | → | TxShield7 | 6 |
| 40 | RxShield7 | ← | RxShield7 | 3 |
| 41 | RxTip7 | ← | RxTip7 | 1 |
| 42 | RxRing7 | ← | RxRing7 | 2 |
| 17 | TxTip6 | → | TxTip6 | 4 |
| 18 | TxRing6 | → | TxRing6 | 5 |
| 16 | TxShield6 | → | TxShield6 | 6 |
| 48 | RxShield6 | ← | RxShield6 | 3 |
| 49 | RxTip6 | ← | RxTip6 | 1 |
| 50 | RxRing6 | ← | RxRing6 | 2 |
| 25 | TxTip5 | → | TxTip5 | 4 |
| 26 | TxRing5 | → | TxRing5 | 5 |
| 24 | TxShield5 | → | TxShield5 | 6 |
| 56 | RxShield5 | ← | RxShield5 | 3 |

| DB68 | Signal | Direction | Signal | RJ45 |
|------|--------|-----------|--------|------|
| 57 | RxTip5 | ← | RxTip5 | 1 |
| 58 | RxRing5 | ← | RxRing5 | 2 |
| 33 | TxTip4 | → | TxTip4 | 4 |
| 34 | TxRing4 | → | TxRing4 | 5 |
| 32 | TxShield4 | → | TxShield4 | 6 |
| 64 | RxShield4 | ← | RxShield4 | 3 |
| 65 | RxTip4 | ← | RxTip4 | 1 |
| 66 | RxRing4 | ← | RxRing4 | 2 |
| 35 | PGND | — | — | — |
| 39 | PGND | — | — | — |
| 43 | PGND | — | — | — |
| 51 | PGND | — | — | — |
| 59 | PGND | — | — | — |
| 67 | DGND | — | — | — |
| 68 | DGND | — | — | — |

## 5.7.3 16CE1 interface cable

There are two types of 16-port CE1 (16CE1) interface cables for the Secure Router 8012: the 16CE1 coaxial cable and the 16CE1 shielded twisted-pair cable. They connect the 75 Ω unshielded interface module and the 120 shielded interface module respectively, as shown in Figure 5-11 and Figure 5-12.

**Figure 5-11** 75-ohm 16CE1 coaxial cable
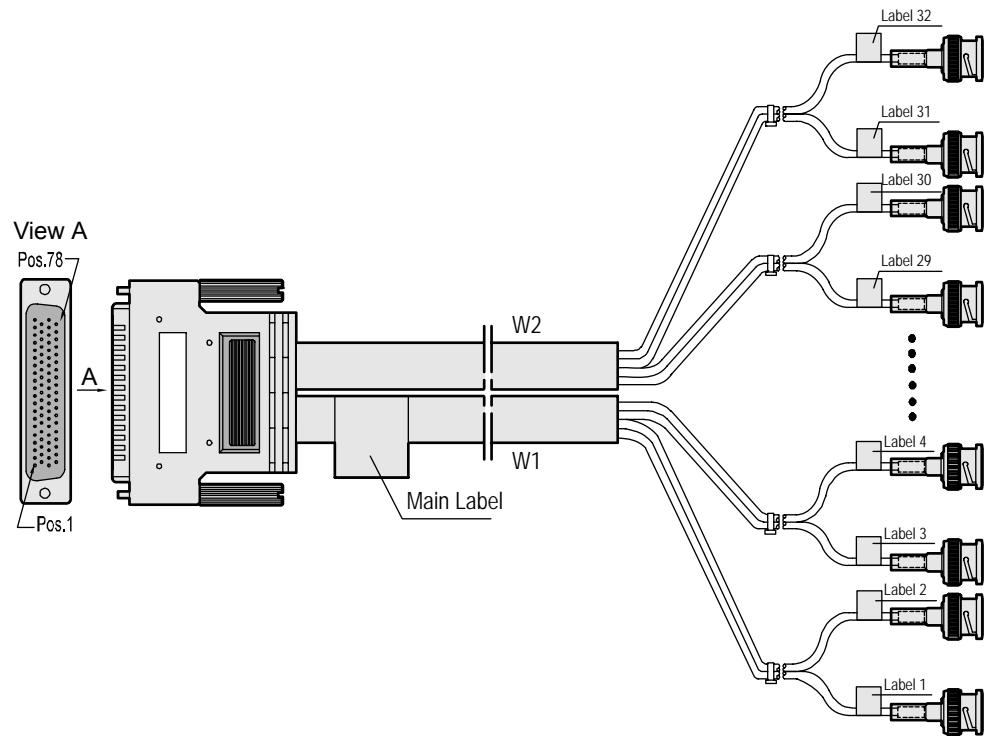


**Figure 5-12** 120-ohm 16CE1 shielded twisted-pair cable
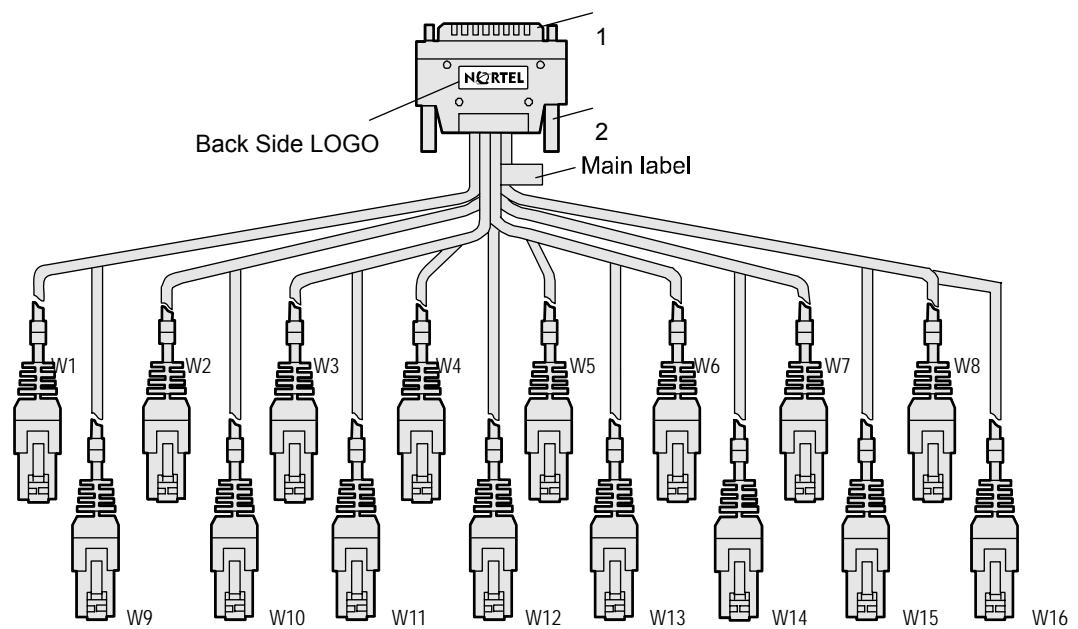
**Table 5-10** Pin assignment of the 16CE1 coaxial cable

| DB78 | Signal | Signal direction | Signal | BNC |
|------|--------|------------------|--------|-----|
| 2 | RxTip1 | ← | — | — |
| 22 | RxRing1 | ← | RxRing1 | No. 1 reception |
| 41 | TxTip1 | → | — | — |
| 61 | TxRing1 | → | TxRing1 | No. 1 transmission |
| 3 | RxTip2 | ← | — | — |
| 23 | RxRing2 | ← | RxRing2 | No. 2 reception |
| 42 | TxTip2 | → | — | — |
| 62 | TxRing2 | → | TxRing2 | No. 2 transmission |
| 4 | RxTip3 | ← | — | — |
| 24 | RxRing3 | ← | RxRing3 | No. 3 reception |
| 43 | TxTip3 | → | — | — |
| 63 | TxRing3 | → | TxRing3 | No. 3 transmission |
| 5 | RxTip4 | ← | — | — |
| 25 | RxRing4 | ← | RxRing4 | No. 4 reception |
| 44 | TxTip4 | → | — | — |
| 64 | TxRing4 | → | TxRing4 | No. 4 transmission |
| 6 | RxTip5 | ← | — | — |
| 26 | RxRing5 | ← | RxRing5 | No. 5 reception |
| 45 | TxTip5 | → | — | — |
| 65 | TxRing5 | → | TxRing5 | No. 5 transmission |
| 7 | RxTip6 | ← | — | — |
| 27 | RxRing6 | ← | RxRing6 | No. 6 reception |
| 46 | TxTip6 | → | — | — |
| 66 | TxRing6 | → | TxRing6 | No. 6 transmission |
| 8 | RxTip7 | ← | — | — |
| 28 | RxRing7 | ← | RxRing7 | No. 7 reception |
| 47 | TxTip7 | → | — | — |
| 67 | TxRing7 | → | TxRing7 | No. 7 transmission |
| 9 | RxTip8 | ← | — | — |
| 29 | RxRing8 | ← | RxRing8 | No. 8 reception |

| DB78 | Signal | Signal direction | Signal | BNC |
|------|--------|------------------|--------|-----|
| 48 | TxTip8 | → | — | — |
| 68 | TxRing8 | → | TxRing8 | No. 8 transmission |
| 12 | RxTip9 | ← | — | — |
| 31 | RxRing9 | ← | RxRing9 | No. 9 reception |
| 51 | TxTip9 | → | — | — |
| 70 | TxRing9 | → | TxRing9 | No. 9 transmission |
| 13 | RxTip10 | ← | — | — |
| 32 | RxRing10 | ← | RxRing10 | No. 10 reception |
| 52 | TxTip10 | → | — | — |
| 71 | TxRing10 | → | TxRing10 | No. 10 transmission |
| 14 | RxTip11 | ← | — | — |
| 33 | RxRing11 | ← | RxRing11 | No. 11 reception |
| 53 | TxTip11 | → | — | — |
| 72 | TxRing11 | → | TxRing11 | No. 11 transmission |
| 15 | RxTip12 | ← | — | — |
| 34 | RxRing12 | ← | RxRing12 | No. 12 reception |
| 54 | TxTip12 | → | — | — |
| 73 | TxRing12 | → | TxRing12 | No. 12 transmission |
| 16 | RxTip13 | ← | — | — |
| 35 | RxRing13 | ← | RxRing13 | No. 13 reception |
| 55 | TxTip13 | → | — | — |
| 74 | TxRing13 | → | TxRing13 | No. 13 transmission |
| 17 | RxTip14 | ← | — | — |
| 36 | RxRing14 | ← | RxRing14 | No. 14 reception |
| 56 | TxTip14 | → | — | — |
| 75 | TxRing14 | → | TxRing14 | No. 14 transmission |
| 18 | RxTip15 | ← | — | — |
| 37 | RxRing15 | ← | RxRing15 | No. 15 reception |

| DB78 | Signal | Signal direction | Signal | BNC |
|------|--------|------------------|--------|-----|
| 57 | TxTip15 | → | — | — |
| 76 | TxRing15 | → | TxRing15 | No. 15 transmission |
| 19 | RxTip16 | ← | — | — |
| 38 | RxRing16 | ← | RxRing16 | No. 16 reception |
| 58 | TxTip16 | → | — | — |
| 77 | TxRing16 | → | TxRing16 | No. 16 transmission |
| 1 | CABLE_TYPE_SEL0 | ←PGND | — | — |
| 10 | PGND | — | — | — |
| 11 | CABLE_TYPE_SEL1 | ←NULL | — | — |
| 20 | PGND | — | — | — |
| 21 | PGND | — | — | — |
| 30 | PGND | — | — | — |
| 39 | PGND | — | — | — |
| 40 | PGND | — | — | — |
| 49 | PGND | — | — | — |
| 50 | PGND | — | — | — |
| 59 | PGND | — | — | — |
| 60 | PGND | — | — | — |
| 69 | PGND | — | — | — |
| 78 | PGND | — | — | — |

**Table 5-11** Pin assignment of the 16CE1 shielded twisted-pair cable

| DB78 | Signal | Signal direction | Signal | RJ45 |
|------|--------|------------------|--------|------|
| 2 | RxTip1 | ← | RxTip1 | 1 |
| 22 | RxRing1 | ← | RxRing1 | 2 |
| 41 | TxTip1 | → | TxTip1 | 4 |
| 61 | TxRing1 | → | TxRing1 | 5 |
| 3 | RxTip2 | ← | RxTip2 | 1 |

| DB78 | Signal | Signal direction | Signal | RJ45 |
|------|--------|------------------|--------|------|
| 23 | RxRing2 | ← | RxRing2 | 2 |
| 42 | TxTip2 | → | TxTip2 | 4 |
| 62 | TxRing2 | → | TxRing2 | 5 |
| 4 | RxTip3 | ← | RxTip3 | 1 |
| 24 | RxRing3 | ← | RxRing3 | 2 |
| 43 | TxTip3 | → | TxTip3 | 4 |
| 63 | TxRing3 | → | TxRing3 | 5 |
| 5 | RxTip4 | ← | RxTip4 | 1 |
| 25 | RxRing4 | ← | RxRing4 | 2 |
| 44 | TxTip4 | → | TxTip4 | 4 |
| 64 | TxRing4 | → | TxRing4 | 5 |
| 6 | RxTip5 | ← | RxTip5 | 1 |
| 26 | RxRing5 | ← | RxRing5 | 2 |
| 45 | TxTip5 | → | TxTip5 | 4 |
| 65 | TxRing5 | → | TxRing5 | 5 |
| 7 | RxTip6 | ← | RxTip6 | 1 |
| 27 | RxRing6 | ← | RxRing6 | 2 |
| 46 | TxTip6 | → | TxTip6 | 4 |
| 66 | TxRing6 | → | TxRing6 | 5 |
| 8 | RxTip7 | ← | RxTip7 | 1 |
| 28 | RxRing7 | ← | RxRing7 | 2 |
| 47 | TxTip7 | → | TxTip7 | 4 |
| 67 | TxRing7 | → | TxRing7 | 5 |
| 9 | RxTip8 | ← | RxTip8 | 1 |
| 29 | RxRing8 | ← | RxRing8 | 2 |
| 48 | TxTip8 | → | TxTip8 | 4 |
| 68 | TxRing8 | → | TxRing8 | 5 |
| 12 | RxTip9 | ← | RxTip9 | 1 |
| 31 | RxRing9 | ← | RxRing9 | 2 |
| 51 | TxTip9 | → | TxTip9 | 4 |
| 70 | TxRing9 | → | TxRing9 | 5 |

| DB78 | Signal | Signal direction | Signal | RJ45 |
|---|---|---|---|---|
| 13 | RxTip10 | ← | RxTip10 | 1 |
| 32 | RxRing10 | ← | RxRing10 | 2 |
| 52 | TxTip10 | → | TxTip10 | 4 |
| 71 | TxRing10 | → | TxRing10 | 5 |
| 14 | RxTip11 | ← | RxTip11 | 1 |
| 33 | RxRing11 | ← | RxRing11 | 2 |
| 53 | TxTip11 | → | TxTip11 | 4 |
| 72 | TxRing11 | → | TxRing11 | 5 |
| 15 | RxTip12 | ← | RxTip12 | 1 |
| 34 | RxRing12 | ← | RxRing12 | 2 |
| 54 | TxTip12 | → | TxTip12 | 4 |
| 73 | TxRing12 | → | TxRing12 | 5 |
| 16 | RxTip13 | ← | RxTip13 | 1 |
| 35 | RxRing13 | ← | RxRing13 | 2 |
| 55 | TxTip13 | → | TxTip13 | 4 |
| 74 | TxRing13 | → | TxRing13 | 5 |
| 17 | RxTip14 | ← | RxTip14 | 1 |
| 36 | RxRing14 | ← | RxRing14 | 2 |
| 56 | TxTip14 | → | TxTip14 | 4 |
| 75 | TxRing14 | → | TxRing14 | 5 |
| 18 | RxTip15 | ← | RxTip15 | 1 |
| 37 | RxRing15 | ← | RxRing15 | 2 |
| 57 | TxTip15 | → | TxTip15 | 4 |
| 76 | TxRing15 | → | TxRing15 | 5 |
| 19 | RxTip16 | ← | RxTip16 | 1 |
| 38 | RxRing16 | ← | RxRing16 | 2 |
| 58 | TxTip16 | → | TxTip16 | 4 |
| 77 | TxRing16 | → | TxRing16 | 5 |
| 1 | CABLE_TYPE_SEL0 | ←PGND | — | — |
| 10 | PGND | — | — | — |

| DB78 | Signal | Signal direction | Signal | RJ45 |
|------|--------|------------------|--------|------|
| 11 | CABLE_TYPE_SEL1 | ←PGND | — | — |
| 20 | PGND | — | — | — |
| 21 | PGND | — | — | — |
| 30 | PGND | — | — | — |
| 39 | PGND | — | — | — |
| 40 | PGND | — | — | — |
| 49 | PGND | — | — | — |
| 50 | PGND | — | — | — |
| 59 | PGND | — | — | — |
| 60 | PGND | — | — | — |
| 69 | PGND | — | — | — |
| 78 | PGND | — | — | — |

## 5.7.4 4CT1/8CT1 interface cable

The 4CT1/8CT1 interface module of Secure Router 8012 is connected with the 120-ohm shielded twisted-pair cable.

Figure 5-8 shows the outline of the 4CT1 cable and Table 5-7 shows the pin assignment. Figure 5-10 shows the outline of the 8CT1 cable and Table 5-9 shows the pin assignment.

## 5.7.5 16CT1 interface cable

The 16CT1 interface cable for the Secure Router 8012 is a 120-ohm shielded twisted-pair cable. Figure 5-12 shows the outline of the 16CT1 cable and Table 5-11 shows the pin assignment.

# 5.8 Channelized E3 interface cable

## 5.8.1 Introduction

The 1CE3 interface module provides two SMB interfaces, which are connected to the Tx end and Rx end of the peer device. The interfaces work in 75-ohm unbalanced transfer mode and are connected with the peer device through a pair of 75-ohm unbalanced coaxial cables.

## 5.8.2 Structure

Figure 5-13 shows the outline of the 1CE3 interface cable.

**Figure 5-13** E3 interface cable
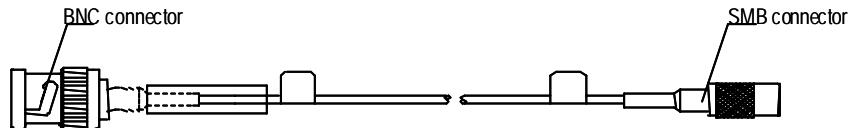


# 5.9 Synchronous serial interface cable

## 5.9.1 Introduction

Every 4SAE interface is 28-core connectors. One end is the DB28 connector to connect with the router, and the other end differs according to the network segment. Both are 3 m in length.

The synchronous serial port cable consists of the following types:

- V.24 (EIA/TIA-232 DTE cable: DB-25 (male) plug at the network end
- V.24 (EIA/TIA-232) DCE cable: DB-25 (female) receptacle at the network end
- V.35 DTE cable: 34PIN (male) plug at the network end
- V.35 DCE cable: 34PIN (female) receptacle at the network end

## 5.9.2 Structure

The outline of the synchronous serial port cable is as follows:

- V.24 DTE cable

**Figure 5-14** V.24 DTE cable
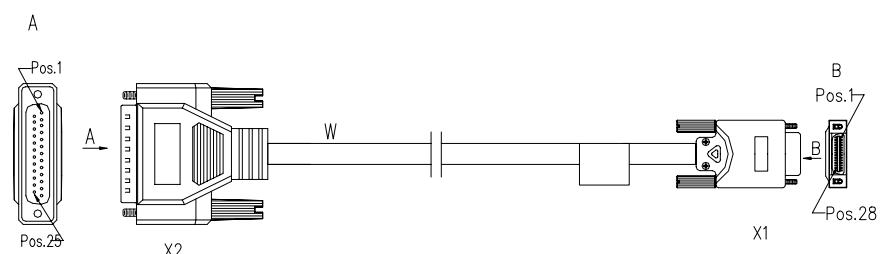


- V.24 DCE cable

**Figure 5-15** V.24 DCE cable
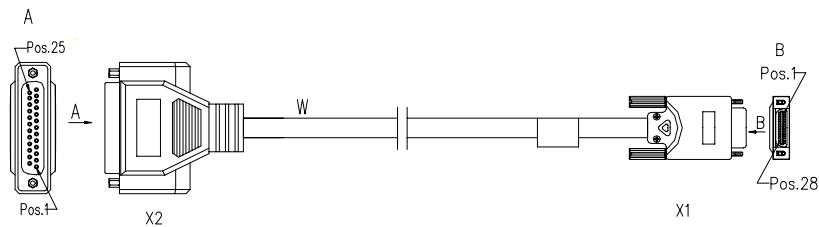


- V.35 DTE cable

**Figure 5-16** V.35 DTE cable
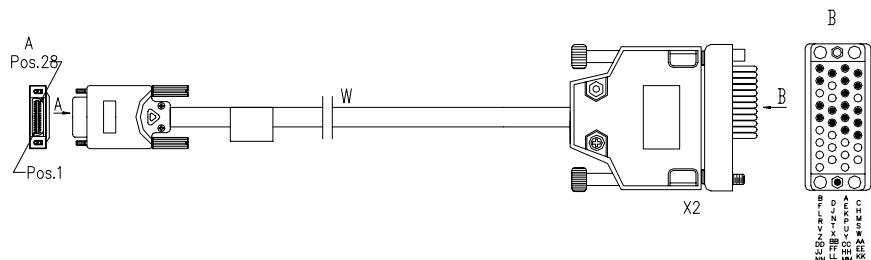


- V.35 DCE cable

**Figure 5-17** V.35 DCE cable
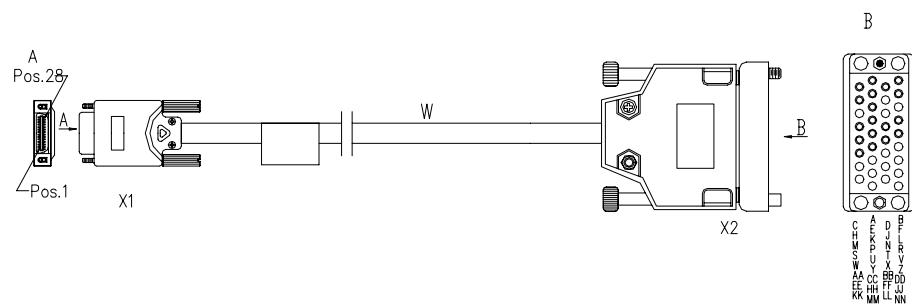


The following tables show the pin assignments for synchronous serial port cable.

**Table 5-12** Pin assignment of the V.24 DTE cable

| DB-28 | Signal | Signal direction | DB-25 | Signal |
|-------|--------|------------------|-------|-------------|
| 6 | GND | — | 7 | Circuit GND |

| DB-28 | Signal | Signal direction | DB-25 | Signal |
|---|---|---|---|---|
| 21 | GND | — | 1 | Shield GND |
| 1 | TxD+ | → | 2 | TxD |
| 19 | RxD+ | ← | 3 | RxD |
| 13 | RTS+ | → | 4 | RTS |
| 23 | CTS+ | ← | 5 | CTS |
| 27 | DTR+ | → | 20 | DTR |
| 25 | DSR+ | ← | 6 | DSR |
| 17 | RxC+ | ← | 17 | RxC |
| 3 | TxC+ | ← | 15 | TxC |
| 15 | TxCE+ | → | 24 | ETC |
| 11 | DCD+ | ← | 8 | DCD |
| 22 | LL | → | 18 | LIST |

**Table 5-13** Pin assignment of the V.24 DCE cable

| DB-28 | Signal | Signal direction | DB-25 | Signal |
|---|---|---|---|---|
| 6 | GND | — | 7 | Circuit GND |
| 21 | GND | — | 1 | Shield GND |
| 19 | RxD+ | ← | 2 | TxD |
| 1 | TxD+ | → | 3 | RxD |
| 23 | CTS+ | ← | 4 | RTS |
| 13 | RTS+ | → | 5 | CTS |
| 25 | DSR+ | ← | 20 | DTR |
| 27 | DTR+ | → | 6 | DSR |
| 15 | TxCE+ | → | 17 | RxC |
| 3 | TxC+ | → | 15 | TxC |
| 17 | RxC+ | ← | 24 | ETC |
| 11 | DCD+ | → | 8 | DCD |
| 22 | LL | ← | 18 | LIST |

**Table 5-14** Pin assignment of the V.35 DTE cable

| DB-28 | Signal | Signal direction | DB-25 | Signal |
|-------|--------|-----------------|-------|--------|
| 6 | GND | — | A | Circuit GND |
| 21 | GND | — | B | Shield GND |
| 1 | TxD+ | → | P | SD+ |
| 2 | TxD- | → | S | SD- |
| 19 | RxD+ | ← | R | RD+ |
| 20 | RxD- | ← | T | RD- |

**Table 5-15** Pin assignment of the V.35 DCE cable

| DB-28 | Signal | Signal direction | DB-25 | Signal |
|-------|--------|-----------------|-------|--------|
| 6 | GND | — | A | Circuit GND |
| 21 | GND | — | B | Shield GND |
| 19 | RxD+ | ← | P | TxD+ |
| 20 | RxD- | ← | S | TxD- |
| 1 | TxD+ | → | R | RxD+ |
| 2 | TxD- | → | T | RxD- |
| 23 | CTS+ | ← | C | RTS |
| 13 | RTS+ | → | D | CTS |
| 25 | DSR+ | ← | H | DTR |
| 27 | DTR+ | → | E | DSR |
| 15 | TxCE+ | → | V | SCR+ |
| 16 | TxCE+ | → | X | SCR- |
| 3 | TxC+ | → | Y | SCT+ |
| 4 | TxC+ | → | AA | SCT- |
| 17 | RxC+ | ← | U | SCTE+ |
| 18 | RxC- | ← | W | SCTE- |
| 11 | DCD+ | → | F | RLSD |
| 22 | LL | ← | J | LL |

# 5.10 HSSI cable

## 5.10.1 Introduction

High Speed Serial Interface cable has two types: the DTE-to-DCE cable (HSSI interface cable) and the DTE-to-DTE cable (null modem cable). All are 3 m in length.

### DTE-to-DCE cable

DTE-to-DCE cable is the straight-through cable. The line sequences of the twisted pairs in the (DB-50) SCSI-II connectors at the two ends are the same. They are used for the connection between the HSSI interface and the communication device in the middle.

### DTE-to-DTE cable

DTE-to-DTE cable is the crossover cable. The line sequences of the twisted pairs in the (DB-50) SCSI-II connectors at the two ends are different. They are used for back-to-back connection among the DTE devices.

## 5.10.2 Structure

DTE-to-DCE cable and DTE-to-DTE cable are both shielded twisted-pair cables. They use the (DB-50) SCSI-II and have similar pin assignment as shown in Figure 5-18.

**Figure 5-18** DTE-to-DCE cable
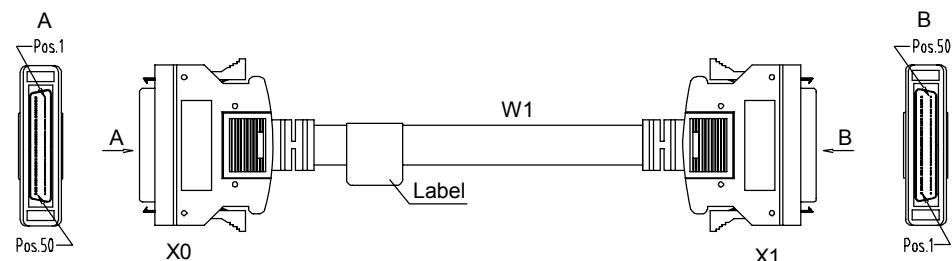


Table 5-16 shows the pin assignment of DTE-to-DCE cables (HSSI interface cable). Table 5-17 shows the pin assignment of DTE-to-DTE cables (null modem cable).

**Table 5-16** Pin assignment of the DTE-to-DCE cable (HSSI interface cable)

| Relation | Color | (DB50) SCSI-II | Signal | Direction | (DB50)SCSI-II | Signal |
|---|---|---|---|---|---|---|
| Pair 1 | White | 1 | SG | — | 1 | SG |
| | Blue | 26 | SG | | 26 | SG |
| Pair 2 | White | 2 | RT+ | ← | 2 | RT+ |
| | Orange | 27 | RT- | | 27 | RT- |

| Relation | Color | (DB50) SCSI-II | Signal | Direction | (DB50)S CSI-II | Signal |
|----------|-------|----------------|--------|-----------|----------------|--------|
| Pair 3 | White | 3 | CA+ | ← | 3 | CA+ |
|  | Green | 28 | CA- |  | 28 | CA- |
| Pair 4 | White | 4 | RD+ | ← | 4 | RD+ |
|  | Brown | 29 | RD- |  | 29 | RD- |
| Pair 5 | White | 5 | LC+ | ← | 5 | LC+ |
|  | Gray | 30 | LC- |  | 30 | LC- |
| Pair 6 | Red | 6 | ST+ | ← | 6 | ST+ |
|  | Blue | 31 | ST- |  | 31 | ST- |
| Pair 7 | Red | 7 | SG | — | 7 | SG |
|  | Orange | 32 | SG |  | 32 | SG |
| Pair 8 | Red | 8 | TA+ | → | 8 | TA+ |
|  | Green | 33 | TA- |  | 33 | TA- |
| Pair 9 | Red | 9 | TT+ | → | 9 | TT+ |
|  | Brown | 34 | TT- |  | 34 | TT- |
| Pair 10 | Red | 10 | LA+ | → | 10 | LA+ |
|  | Gray | 35 | LA- |  | 35 | LA- |
| Pair 11 | Black | 11 | SD+ | → | 11 | SD+ |
|  | Blue | 36 | SD- |  | 36 | SD- |
| Pair 12 | Black | 12 | LB+ | → | 12 | LB+ |
|  | Orange | 37 | LB- |  | 37 | LB- |
| Pair 13 | Black | 13 | SG | — | 13 | SG |
|  | Green | 38 | SG |  | 38 | SG |
| Pair 14 | Black | 14 | Ancillary to DCE | — | 14 | Ancillary to DCE |
|  | Brown | 39 | Ancillary to DCE |  | 39 | Ancillary to DCE |
| Pair 15 | Black | 15 | Ancillary to DCE | — | 15 | Ancillary to DCE |
|  | Gray | 40 | Ancillary to DCE |  | 40 | Ancillary to DCE |
| Pair 16 | Yellow | 16 | Ancillary to DCE | — | 16 | Ancillary to DCE |

| Relation | Color | (DB50) SCSI-II | Signal | Direction | (DB50)S CSI-II | Signal |
|---|---|---|---|---|---|---|
| | Blue | 41 | Ancillary to DCE | | 41 | Ancillary to DCE |
| Pair 17 | Yellow | 17 | Ancillary to DCE | — | 17 | Ancillary to DCE |
| | Orange | 42 | Ancillary to DCE | | 42 | Ancillary to DCE |
| Pair 18 | Yellow | 18 | Ancillary to DCE | — | 18 | Ancillary to DCE |
| | Green | 43 | Ancillary to DCE | | 43 | Ancillary to DCE |
| Pair 19 | Yellow | 19 | SG | ← | 19 | SG |
| | Brown | 44 | SG | | 44 | SG |
| Pair 20 | Yellow | 20 | Ancillary from DCE | — | 20 | Ancillary from DCE |
| | Gray | 45 | Ancillary from DCE | | 45 | Ancillary from DCE |
| Pair 21 | Violet | 21 | Ancillary from DCE | — | 21 | Ancillary from DCE |
| | Blue | 46 | Ancillary from DCE | | 46 | Ancillary from DCE |
| Pair 22 | Violet | 22 | Ancillary from DCE | — | 22 | Ancillary from DCE |
| | Orange | 47 | Ancillary from DCE | | 47 | Ancillary from DCE |
| Pair 23 | Violet | 23 | Ancillary from DCE | — | 23 | Ancillary from DCE |
| | Green | 48 | Ancillary from DCE | | 48 | Ancillary from DCE |
| Pair 24 | Violet | 24 | Ancillary from DCE | — | 24 | Ancillary from DCE |
| | Brown | 49 | Ancillary from DCE | | 49 | Ancillary from DCE |
| Pair 25 | Violet | 25 | SG | — | 25 | SG |
| | Gray | 50 | SG | | 50 | SG |

**Table 5-17** Pin assignment of the DTE-to-DTE cable (null modem cable)

| Relation | Color | (DB50) SCSI-II | Signal | Direction | (DB50) SCSI-II | Signal |
|---|---|---|---|---|---|---|
| Pair 1 | White | 1 | SG | — | 1 | SG |
| | Blue | 26 | SG | — | 26 | SG |
| Pair 2 | White | 2 | RT+ | ← | 9 | TT+ |
| | Orange | 27 | RT- | ← | 34 | TT- |
| Pair 3 | White | 3 | CA+ | ← | 8 | TA+ |
| | Green | 28 | CA- | ← | 33 | TA- |
| Pair 4 | White | 4 | RD+ | ← | 11 | SD+ |
| | Brown | 29 | RD- | ← | 36 | SD- |
| Pair 5 | White | 5 | LC+ | Not connected | 10 | LA+ |
| | Gray | 30 | LC- | Not connected | 35 | LA- |
| Pair 6 | Red | 6 | ST+ | Not connected | 6 | ST+ |
| | Blue | 31 | ST- | Not connected | 31 | ST- |
| Pair 7 | Red | 7 | SG | — | 7 | SG |
| | Orange | 32 | SG | — | 32 | SG |
| Pair 8 | Red | 8 | TA+ | → | 3 | CA+ |
| | Green | 33 | TA- | → | 28 | CA- |
| Pair 9 | Red | 9 | TT+ | → | 2 | RT+ |
| | Brown | 34 | TT- | → | 27 | RT- |
| Pair 10 | Red | 10 | LA+ | Not connected | 5 | LC+ |
| | Gray | 35 | LA- | Not connected | 30 | LC- |
| Pair 11 | Black | 11 | SD+ | → | 4 | RD+ |
| | Blue | 36 | SD- | → | 29 | RD- |
| Pair 12 | Black | 12 | Loopback (not connected) | — | 12 | Loopback (not connected) |

| Relation | Color | (DB50) SCSI-II | Signal | Direction | (DB50) SCSI-II | Signal |
|---|---|---|---|---|---|---|
| | Orange | 37 | Loopback (not connected) | — | 37 | Loopback (not connected) |
| Pair 13 | Black | 13 | SG | — | 13 | SG |
| | Green | 38 | SG | — | 38 | SG |
| Pair 14 | Black | 14 | Not used | — | 14 | Not used |
| | Brown | 39 | Not used | — | 39 | Not used |
| Pair 15 | Black | 15 | Not used | — | 15 | Not used |
| | Gray | 40 | Not used | — | 40 | Not used |
| Pair 16 | Yellow | 16 | Not used | — | 16 | Not used |
| | Blue | 41 | Not used | — | 41 | Not used |
| Pair 17 | Yellow | 17 | Not used | — | 17 | Not used |
| | Orange | 42 | Not used | — | 42 | Not used |
| Pair 18 | Yellow | 18 | Not used | — | 18 | Not used |
| | Green | 43 | Not used | — | 43 | Not used |
| Pair 19 | Yellow | 19 | SG | — | 19 | SG |
| | Brown | 44 | SG | — | 44 | SG |
| Pair 20 | Yellow | 20 | Not used | — | 20 | Not used |
| | Gray | 45 | Not used | — | 45 | Not used |
| Pair 21 | Violet | 21 | Not used | — | 21 | Not used |
| | Blue | 46 | Not used | — | 46 | Not used |
| Pair 22 | Violet | 22 | Not used | — | 22 | Not used |
| | Orange | 47 | Not used | — | 47 | Not used |
| Pair 23 | Violet | 23 | Not used | — | 23 | Not used |
| | Green | 48 | Not used | — | 48 | Not used |
| Pair 24 | Violet | 24 | Not used | — | 24 | Not used |
| | Brown | 49 | Not used | — | 49 | Not used |

| Relation | Color | (DB50) SCSI-II | Signal | Direction | (DB50) SCSI-II | Signal |
|---|---|---|---|---|---|---|
| Pair 25 | Violet | 25 | SG | — | 25 | SG |
| | Gray | 50 | SG | — | 50 | SG |

📖 **NOTE**

Refer to the previous table to produce two Ethernet cables. Arrange the line order according to this chromatogram.

# Contents

# Tables

# A List of indicators

## A.1 Board indicators

### A.1.1 RPU indicators

Table A-1 shows the status and description of RPU indicators.

**Table A-1** Discription of the RPU front panel components

| Name | Silkscreen | Description |
|------|-----------|-------------|
| ALM (red) | SYS | The system running LED, including the fan, power supply, and Network Process Unit (NPU) warnings. Constant ON means the CPU has received a warning. |
| | NPU | The NPU failure LED. Constant ON means the NPU failed. |
| RPU (green) | RUN | The system running state LED. Blinking means the CPU works normally. Constant ON or OFF means the CPU failed. |
| | MST | The standby state LED. On means that the board is the master RPU. |
| NPU1 (green) | RUN | The system running state LED. Blinking means the CPU is in normal operation. Constant ON or OFF means the CPU failed. |
| | MST | The standby state LED. On means that the board is the master NPU. |
| NPU2 (green) | RUN | The system running state LED. Blinking means the CPU is in normal operation. Constant ON or OFF means the CPU failed. |
| | MST | The standby state LED. On means that the board is the master NPU. |
| FAN | PRN (green) | The LED of the fan position. Constant ON means the fan is in position. |

| Name | Silkscreen | Description |
|------|-----------|-------------|
| | ALM (red) | The fan warning LED. Constant ON means the fan is not in position or has failed. |
| PWR1 | PRN (green) | The LED of the first power module in position. Constant ON means the power module is in position. Constant OFF means the power module is not in position. |
| | ALM (red) | The first power module failure LED. Constant ON means the power module disabled or has failed. |
| PWR2 | PRN (green) | The LED of the second power module in position. Constant ON means the power module is in position. Constant OFF means the power module is not in position . |
| | ALM (red) | The second power module failure LED. Constant ON means the power module disabled or has failed. |
| 10/100/1000M Ethernet 0 | LINK (green) | OFF means the link is not connected and ON means the link is connected. |
| | ACT (yellow) | OFF means no data is being transmitted on the interface and blinking means data is being transmitted or received. |
| 100/1000M Ethernet 1 | LINK (green) | OFF means the link is not connected and ON means the link is connected. |
| | ACT (yellow) | OFF means no data is being transmitted on the interface and blinking means data is being transmitted or received. |
| 100/1000M Ethernet 2 | LINK (green) | OFF means the link is not connected and ON means the link is connected. |
| | ACT (yellow) | OFF means no data is being transmitted on the interface and blinking means data is being transmitted or received. |

## A.1.2 NPU indicators

Table A-2 shows the status and description of NPU indicators.

**Table A-2** Description of NPU indicators

| Name | Description |
|------|-------------|
| RUN (Green) | The running LED. Blinking means the NPU works normally. Constant OFF means the NPU is not in position or it failed. |
| ALM (Red) | The alarm LED. Constant ON means the NPU failed. |

## A.1.3 HIC/FIC indicators

Table A-3 shows the status and description of HIC/FIC indicators.

**Table A-3** HIC/FIC indicators

| Name | Description |
|---|---|
| LINK (Green) | OFF means the link is not connected and ON means the link is connected. |
| ACT (Yellow) | OFF means no data is being transmitted or received on the interface and blinking means data is being transmitted or received. |

# A.2 Fan module indicators

The indicators of the fan module are located on the RPU front panel. Table A-4 shows the status and description of the indicators.

**Table A-4** Indicators of the fan module

| Name | Color | Description |
|---|---|---|
| RUN | Green | Constant ON means the fan is operating normally. |
| ALM | Red | ON means the FAN has failed. |

# A.3 Power module indicators

Table A-5 shows the status and description of the power module indicators.

**Table A-5** Indicators of the power module

| Name | Color | Implication |
|---|---|---|
| AC OK | Green | The power module input LED (only for the AC power module). Constant ON means the voltage input is normal (100 V to 240 V), and OFF means the voltage input is not normal. |
| DC OK | Green | The power module input LED (only for the DC power module). Constant ON means the voltage input is normal (-48 V to -60 V), and OFF means the voltage input is not normal. |
| RUN | Green | The power module indicators. Constant ON means the power module runs normally, and OFF means the power module has faults. |

| Name | Color | Implication |
|------|-------|-------------|
| ALM | Red | The power module fault indicator. Constant ON means the power module has faults. |

The running state of the power module is available from the indicators on the RPU front panel. Table A-6 shows the status and description of the indicators.

**Table A-6** Indicators of the power module on the RPU front panel

| Type | Silkscreen | Description |
|------|-----------|-------------|
| PWR1 LED | PRN (green) | The LED of the first power module in position. Constant ON means the power module is in position. Constant OFF means the power module is not in position. |
|  | ALM (red) | The first power module failure LED. Constant ON means the power module failed. |
| PWR2 LED | PRN (green) | The LED of the second power module in position. Constant ON means the power module is in position. Constant OFF means the power module is not in position. |
|  | ALM (red) | The second power module failure LED. Constant ON means the power module failed. |

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# Contents

# Tables

# B List of boards

## B.1 Boards

Table B-1 lists the boards supported by the Secure Router 8012.

**Table B-1** Boards supported by the Secure Router 8012

| Silkscreen | Full name |
|---|---|
| RPU | Routing Process Unit |
| NPU | Network Process Unit |
| 4CE1 | 4-port channelized E1 module |
| 4E1 | 4-port unchannelized E1 module |
| 8CE1 | 8-port channelized E1 module |
| 8E1 | 8-port unchannelized E1 module |
| 16xCE1 DB78 75ohm | 16-port Channelized E1-DB78-75ohm,Interface Board for the Secure Router 8012 |
| 4CT1 | 4-port channelized T1 module |
| 8CT1 | 8-port channelized T1 module |
| 1xOC3/STM1 CPOSCT1(SFP) | 11-port OC-3/STM-1 CPOS-Channelized T1-Optical Interface Board(SFP) for the Secure Router 8012 |
| 1CE3 | 1-port channelized E3 module |
| 4SAE | 4-port enhanced high-speed synchronous serial interface module |
| 1AE3 | 1-port ATM over E3 module |
| 1xOC3/STM1 ATM(SFP) | 1-port OC-3/STM-1 ATM High Speed Optical Interface Board(SFP) for the Secure Router 8012 |
| 2xOC3/STM1 ATM(SFP) | 2-port OC-3/STM-1 ATM High Speed Optical Interface Board(SFP) for the Secure Router 8012 |

| Silkscreen | Full name |
|---|---|
| 4xOC3/STM1 ATM (HIC) (SFP) | 4-port OC-3/STM-1 ATM (HIC) High Speed Optical Interface Board(SFP) for the Secure Router 8012 |
| 1CPOS(E) | 1-port channelized POS optical module |
| 2xFE UTP | 2-Port 100M Ethernet High Speed Electrical Interface Card (RJ45) for the Secure Router 8002, 8004, and 8008 |
| 4xFE UTP | 4-Port 100M Ethernet High Speed Electrical Interface Card (RJ45) for the Secure Router 8002, 8004, and 8008 |
| 8xFE UTP | 8-port 100M Ethernet High Speed Electrical interface Card (RJ45) for the Secure Router 8002, 8004, and 8008 |
| 2xFE Optical | 2-Port Fast Ethernet High Speed Optical Interface Card (SFP) for the Secure Router 8002, 8004, and 8008 |
| 4xFE Optical | 4-Port Fast Ethernet High Speed Optical Interface Card (SFP) for the Secure Router 8002, 8004, and 8008 |
| 8xFE Optical | 8-Port Fast Ethernet High Speed Optical Interface Card (SFP) for the Secure Router 8002, 8004, and 8008 |
| 1xGig E (SFP) | High Speed 1-port 1000M Ethernet card(SFP) for the Secure Router 8002, 8004, and 8008 |
| 2xGig E (SFP) | High Speed 2-port 1000M Ethernet card(SFP) for the Secure Router 8002, 8004, and 8008 |
| 1x155 POS | High Speed 1-port 155M POS card(SFP) for the Secure Router 8002, 8004, and 8008 |
| 2x155 POS | High Speed 2-port 155M POS card(SFP) or the Secure Router 8002, 8004, and 8008 |
| 4x155 POS | High Speed 4-port 155M POS card(SFP) for the Secure Router 8002, 8004, and 8008 |
| 1xOC3/STM1 CPOSCE1(SFP) | 1-port OC-3/STM-1 CPOS-Channelized E1 Optical Interface Board(SFP) for the Secure Router 8012 |
| 1xOC3/STM1 CPOSCT1(SFP) | 1-port OC-3/STM-1 CPOS-Channelized T1-Optical Interface Board(SFP) for the Secure Router 8012 |
| 1xSTM1/POS-SFP-HIC-SR8012 | 1-port 155M POS (HIC) High Speed Optical Interface Board(SFP) for the Secure Router 8012 |
| 2xSTM1/POS-SFP-HIC-SR8012 | 2-port 155M POS (HIC) High Speed Optical Interface Board(SFP) for the Secure Router 8012 |
| 4xSTM1/POS-SFP-HIC-SR8012 | 4-port 155M POS (HIC) High Speed Optical Interface Board(SFP) or the Secure Router 8012 |
| 1HSSI | 1-port HSSI interface module |
| 2HSSI | 2-port HSSI interface module |

| Silkscreen | Full name |
|---|---|
| IPSec Module | IPSEC High Speed Interface Board for the Secure Router 8002, 8004, and 8008 |

# B.2 RPU

Table B-2 lists the attributes of the console port.

**Table B-2** Console interface attributes

| Attribute | Description |
|---|---|
| Connector type | RJ-45 |
| Standard | RS-232 |
| Baud rate | 9600 bit/s to 115 200 bit/s<br>9600 bit/s by default |

Table B-3 lists the attributes of the AUX port.

**Table B-3** AUX interface attributes

| Attribute | Description |
|---|---|
| Connector type | RJ-45 |
| Standard | Asynchronous EIA/TIA-232 |
| Baud rate | 300 to 115 200 bit/s |
| Supported protocol | PPP<br>SLIP<br>MP |

Table B-4 lists the attributes of the 10/100/1000M Ethernet port.

**Table B-4** 10/100/1000M Ethernet interface attributes

| Attribute | Description |
|---|---|
| Connector type | RJ-45 |
| Standard | MDI |

| | |
|---|---|
| Supported frame format | Ethernet_II<br>Ethernet_SNAP<br>IEEE 802.2<br>IEEE 802.3 |
| Operating mode | 10/100/1000 Mbit/s autosensing<br>Full duplex<br>Half duplex |
| Supported network protocol | IP |

Table B-5 lists the attributes of the 100/1000M Ethernet interface

**Table B-5** Attributes of the 100/1000M Ethernet interface

| Attribute | Description |
|---|---|
| Connector type | SFP optical module |
| Number of interfaces | 2 |
| Supported frame format | Ethernet_II<br>Ethernet_SNAP |
| Working mode | 100M/1000 Mbit/s autosensing<br>Full duplex |
| Supported network protocol | IP |

# B.3 10/100Base-TX FE electrical interface module

Table B-6 lists the attributes of the 10/100Base-TX FE electrical interface.

**Table B-6** Attributes of 10/100Base-TX FE electrical interfaces

| Attribute | Description |
|---|---|
| Connector type | RJ45 |
| Cable type | Standard Ethernet cable |
| Transmission distance | 100 m (with Category 5 UTP cable) |
| Operating mode | Full duplex/half duplex<br>10M/100 Mbit/s auto-negotiation |

| Attribute | Description |
|---|---|
| Compliant standard | IEEE 802.3u |
| Supported frame format | Ethernet_II<br>Ethernet_SNAP |
| Supported network protocol | IP |

# B.4 100Base-FX Ethernet optical interface module

Table B-8 lists the attributes of the 100Base-FX Ethernet optical interface.

**Table B-7** Attributes of the 100Base-FX Ethernet optical interface

| Item | Description |
|---|---|
| Interface type | SFP optical interface. For the module configuration, see Table B-8. |
| Duplex mode | Full duplex |
| Rate | 100 Mbit/s |
| Applicable standard | IEEE 802.3u |
| Supported frame format | Ethernet_II<br>Ethernet_SNAP |
| Supported network protocol | IP |

**Table B-8** Attributes of the 100M-FX Ethernet interface SFP optical module

| Item | | Description | | | |
|---|---|---|---|---|---|
| Maximum transmission distance | | 2 km | 15 km | 40 km | 80 km |
| Central wavelength | | 1310 nm | 1310 nm | 1310 nm | 1550 nm |
| Optical fiber type | | Multimode | Single-mode | Single-mode | Single-mode |
| Output power | Minimum | –19 dBm | –15 dBm | –5 dBm | –5 dBm |
| | Maximum | –14 dBm | –8 dBm | 0 dBm | 0 dBm |
| Receiver sensitivity | | –30 dBm | –31 dBm | –37 dBm | –37 dBm |
| Sender type | | LD | LED | | |

| Connector type | LC |
|---|---|

# B.5 1000Base-X Ethernet optical interface module

Table B-9 lists the attributes of the 1000Base-X Ethernet optical interface.

**Table B-9** Attributes of the 1000Base-X Ethernet interface module

| Item | Description | |
|---|---|---|
| | **2GE** | **1GE** |
| Interface type | SFP interface (Configure this module separately. See Table B-10 for attributes of SFP optical module and Table B-11 for attributes of SFP electrical interface module.) | |
| Interface number | 2 | 1 |
| Duplex mode | Full duplex | |
| Rate | 1.25 Gbit/s | |
| Standard compliance | IEEE 802.3z | |
| Frame format | Ethernet_II Ethernet_SNAP | |
| Network protocol | IP | |

**Table B-10** Attributes of the SFP optical module of the 1000Base-X Ethernet interface

| Attributes | Description | | | | | |
|---|---|---|---|---|---|---|
| Transmission distance | 0.55 km | 10 km | 40 km | 40 km | 80 km | 100 km |
| Central wavelength | 850 nm | 1310 nm | 1310 nm | 1550 nm | 1550 nm | 1550 nm |
| Minimum output power | –9.5 dBm | –9.5 dBm | –5 dBm | –4.0 dBm | –5.0 dBm | –5 dBm |
| Maximum output power | 0 dBm | –3.0 dBm | –2 dBm | 0 dBm | –2.0 dBm | 0 dBm |
| Receiver sensitivity | –17.0 dBm | –20.0 dBm | –23 dBm | –22.0 dBm | –23.0 dBm | –30.0 dBm |

| Attributes | Description | | | | | |
|---|---|---|---|---|---|---|
| Optical fiber type | Multimode | Single-mode | Single-mode | Single-mode | Single-mode | Single-mode |
| Connector type | LC | | | | | |

**Table B-11** Attributes of SFP module of 1000Base-X Ethernet electrical interface

| Item | Description |
|---|---|
| Transmission distance | 100 m |
| Duplex | Full-duplex |
| Connector type | RJ-45 |
| Rate | 1000 Mbit/s |

# B.6 Channelized and unchannelized E1/T1 interface module

Table B-12 lists the attributes of the channelized and unchannelized E1/T1 Interface.

**Table B-12** Attributes of channelized and unchannelized E1/T1 interface

| Attribute | Description | | | |
|---|---|---|---|---|
| | **4/8E1** | **4/8/16CE1** | **4/8CT1** | **16CT1** |
| Connector type | • DB-68 (4/8E1,4/8CE1 and 4/8CT1)<br>• DB-78 (16CE1 and 16CT1) | | | |
| Operating mode | E1 | E1 and CE1 | T1 and CT1 | |
| Transmission rate | • In E1 mode: 2048 kbit/s<br>• In CE1 mode: N x 64 kbit/s (N = 1 to 31) | | • In T1 mode: 1544 kbit/s<br>• In CT1 mode: N x 56 kbit/s and N x 64 kbit/s (N = 1 to 24) | |
| Cable model | 75 coaxial cable<br>120 Ωshielded twisted pair cable | | 120 shielded twisted pair cable | |
| Maximum transmission distance | 75Ω coaxial cable: 0.5 km<br>120Ω shielded twisted pair cable 0.15 km | | 0.15 km | |

| Attribute | Description | | | |
|---|---|---|---|---|
| | **4/8E1** | **4/8/16CE1** | **4/8CT1** | **16CT1** |
| Interface standard | ITU-T G.703 and ITU-T G.704 | | | |
| Supported network protocol | IP | | | |
| Other supported protocols | PPP, LAPB, X.25, Frame Relay, HDLC, and MP (16CE1/16CT1 supports PPP, HDLC, and MP.) | | | |

📖 **NOTE**

When the router works in CT1 mode, the default setting is binding time slots as N x 56 kbit/s (N = 1 to 24).

# B.7 Channelized E3 interface modules

Table B-13 lists the attributes of the channelized E3 interface module.

**Table B-13** Attributes of the channelized E3 interface module

| Attribute | Description |
|---|---|
| | **1CE3** |
| Connector type | SMB |
| Cable type | 75-ohm coaxial cable |
| Operating mode | E3, CE3, and CE1 |
| Interface rate | E3 mode: 34.368 Mbit/s<br>CE3 mode: providing 16 E1 channels with a rate of 2.048 Mbit/s per E1 channel<br>CE1 mode: N x 64 kbit/s (N = 1 to 31) |
| Max. transmit distance | 0.1 km |
| Interface standard | ITU-T G.703 and G.704 |
| Supported network protocol | IP |
| Other supported protocols | PPP, MP, Frame Relay, MFR, and HDLC |

# B.8 Synchronous serial port module

Table B-14 lists the attributes of the synchronous serial port.

**Table B-14** Attributes of the 4SAE interface

| Attribute | Description | |
|---|---|---|
| Connector type | DB-28 | |
| Interface standard and working mode | V.24 | V.35 |
| | DTE and DCE | DTE<br>DCE |
| Minimum baud rate (bit/s) | 1200 | 1200 |
| Maximum baud rate (bit/s) | 64 k | 2.048 M |
| Cable type | V.24 DTE cable<br>V.24 DCE cable<br>V.35 DTE cable<br>V.35 DCE cable | |
| Supported protocols | PPP<br>HDLC<br>Frame Relay<br>MFR<br>MP | |

# B.9 ATM 155M optical interface module

Table B-15 shows the attributes of the optical interface module.

**Table B-15** Attributes of the ATM 155M optical interface

| Attribute | Description |
|---|---|
| Interface rate | 155 Mbit/s |
| Interface standard | SONET/SDH |
| Supported service type | ATM Traffic Constant Bit Rate (CBR)<br>rt_Variable Bit Rate-Real Time (VBR)<br>nrt_Variable Bit Rate-Non Real Time (VBR)<br>Unspecified Bit Rate (UBR) |

| Supported protocols | IPoA |
|---|---|
| | IPoEoA |
| | PPPoA |
| | PPPoEoA |
| | **NOTE** |
| | The HIC high-speed ATM 155M optical interface supports only IPoA. |

The FIC low-speed ATM 155M SFP optical module is placed inside. The attributes of this module are shown in Table B-16.

**Table B-16** Attributes of the SFP optical module with the ATM 155M optical interface

| Item | | Description | | |
|---|---|---|---|---|
| | | **Multi-mode optical interface** | **Single-mode optical interface** | **Single-mode optical interface with long haul** |
| Connector type | | SC | SC | SC |
| Transmitting power | Minimum | –15 dBm | –19 dBm | –5 dBm |
| | Maximum | –8 dBm | –14 dBm | 0 dBm |
| Receiver sensitivity | Minimum | –28 dBm | –30 dBm | –34 dBm |
| | Maximum | –8 dBm | –14 dBm | –10 dBm |
| Sender type | | LED | LD | LD |
| Wavelength | | 1310 nm | | |
| Maximum transmission distance | | 2 km | 15 km | 30 km |

The HIC high-speed ATM 155M SFP optical module is provided separately. The attributes of this module are shown in Table B-17.

**Table B-17** Attributes of the HIC high-speed ATM 155M SFP optical module

| Item | | Description | | | |
|---|---|---|---|---|---|
| Maximum transmission distance | | 2 km | 15 km | 40 km | 80 km |
| Central wavelength | | 1310 nm | 1310 nm | 1310 nm | 1550 nm |
| Optical fiber type | | Multimode | Single-mode | Single-mode | Single-mode |
| Output power | Minimum | –19 dBm | –15 dBm | –5 dBm | –5 dBm |

| | | | | | |
|---|---|---|---|---|---|
| | Maximum | –14 dBm | –8 dBm | 0 dBm | 0 dBm |
| Receiver sensitivity | | –30 dBm | –31 dBm | –37 dBm | –37 dBm |
| Sender type | | LD | LED | | |
| Connector type | | LC | | | |

# B.10 Channelized and unchannelized POS optical interface module

Table B-18 lists the attributes of the channelized and unchannelized POS optical interface.

**Table B-18** Attributes of the channelized and unchannelized POS optical interface

| Item | Description |
|---|---|
| Rate | 155 Mbit/s |
| Operating mode | Unchannelized: 155 Mbit/s and full duplex<br>channelized: 63 E1 channels or 84 T1 channels |
| Applicable standard | STM-1/OC-3c SONET/SDH<br>Supporting IETF RFC1619/1661/1662 |
| Supported network protocol | IP |
| Supported protocols | PPP<br>HDLC<br>Frame Relay<br>MFR (Only 1CPOS(E) supports Frame Relay and MFR.) |

**Table B-19** Attributes of the SFP optical module of the channelized/unchannelized POS optical interface

| Item | | Description | | | |
|---|---|---|---|---|---|
| Maximum transmission distance | | 2 km | 15 km | 40 km | 80 km |
| Central wavelength | | 1310 nm | 1310 nm | 1310 nm | 1550 nm |
| Optical fiber type | | Multimode | Single-mode | Single-mode | Single-mode |
| Output power | Minimum | –19 dBm | –15 dBm | –5 dBm | –5 dBm |
| | Maximum | –14 dBm | –8 dBm | 0 dBm | 0 dBm |

| Item | Description | | | |
|------|-------------|--|--|--|
| Receiver sensitivity | –30 dBm | –31 dBm | –37 dBm | –37 dBm |
| Sender type | LD | LED | | |
| Connector type | LC | | | |

# B.11 HSSI interface module

Table B-20 shows the attributes of the HSSI interface.

**Table B-20** Attributes of the HSSI interface

| Item | Description |
|------|-------------|
| Type | HSSI electrical interface |
| Rate | 52 Mbit/s |
| Working mode | Unchannelized: 51.84M |
| Standard compliance | Compliant with STS-1 |
| Supported network protocol | IP |
| Supported link layer protocols | PPP HDLC |

# B.12 IPSec encryption HIC

Table B-21 lists the attributes of the IPSec encryption HIC.

**Table B-21** Attributes of the IPSec encryption HIC

| Item | Description |
|------|-------------|
| Supported protocol | IPSec/IKE |
| Supported maximum concurrent IPSec connections | • Site-to-Site: 5000 <br> • Virtual Private Dial-up Network (VPDN): 12 000 |
| Hardware algorithm | Encryption algorithms: DES, 3DES, AES128, AES192, AES256, and SCB2 <br> Encryption mode: CBC |

# Contents

# C Acronyms and abbreviations

**A**

| | |
|---|---|
| **AC** | Alternating Current |
| **ATM** | Advanced Traffic Management |
| **AUX** | Auxiliary (port) |

**C**

| | |
|---|---|
| **CPU** | Central Processing Unit |
| **CSU** | Channel Service Unit |

**D**

| | |
|---|---|
| **DC** | Direct Current |
| **DCD** | Data Carrier Detect |
| **DCE** | Data Circuit-terminating Equipment |
| **DSR** | Data Set Ready |
| **DSU** | Data Service Unit |
| **DTE** | Data Terminal Equipment |
| **DTR** | Data Terminal Ready |

**E**

| | |
|---|---|
| **EMC** | Electro Magnetic Compatibility |
| **EPLD** | Erasable Programmable Logic Device |

**F**

| | |
|---|---|
| **FE** | Fast Ethernet |

| | |
|---|---|
| **FIC** | Flexible Interface Card |
| **FPGA** | Field Programmable Gate Array |
| | |
| **G** | |
| **GE** | Gigabit Ethernet |
| **GND** | Ground |
| | |
| **H** | |
| **HDLC** | High-level Data Link Control |
| **HIC** | High-speed Interface Card |
| | |
| **I** | |
| **IEEE** | Institute of Electrical and Electronics Engineers |
| **IETF** | Internet Engineering Task Force |
| **IP** | Internet Protocol |
| **ISDN** | Integrated Services Digital Network |
| | |
| **L** | |
| **LAN** | Local Area Network |
| **LC** | Lucent Connector |
| **LD** | Laser Diode |
| **LED** | Light-emitting diode |
| | |
| **M** | |
| **MFR** | Multiple Frame Relay |
| **MP** | Multilink Protocol |
| **MPLS** | Multiprotocol Label Switching |
| **MTBF** | Mean Time Between Failure |
| **MTTR** | Mean Time To Repair |
| | |
| **N** | |
| **NEG** | Negative |
| **NPU** | Network Process Unit |

| | |
|---|---|
| **NVRAM** | Non-Volatile Random Access Memory |
| **O** | |
| **ODF** | Optical Distribution Frame |
| **P** | |
| **PC** | Personal Computer |
| **PGND** | Protection Ground |
| **POS** | Packet Over SDH/SONET |
| **PPP** | Point-to-Point Protocol |
| **PPPoA** | Point to Point Protocol over ATM Adaptation Layer 5 |
| **PRI** | Primary Rate Interface |
| **Q** | |
| **QoS** | Quality of Service |
| **R** | |
| **RH** | Relative Humidity |
| **RJ45** | Registered Jack 45 |
| **RPM** | Round Per Minute |
| **RPU** | Routing Process Unit |
| **S** | |
| **SA** | Security Association |
| **SC** | Square Connector |
| **SDH** | Synchronous Digital Hierarchy |
| **SDRAM** | Synchronous Dynamic Random Access Memory |
| **SFP** | Small Form-Factor Pluggable |
| **SLIP** | Serial Line Internet Protocol |
| **SMB** | Sub-miniature B |
| **SNAP** | Sub Network Access Point |
| **SONET** | Synchronous Optical Network |
| **ST** | Segment Type |

**U**

**UBR**                                    Unspecified Bit Rate

**UL**                                     Underwriter Laboratories Inc.


**V**

**VBR**                                    Variable Bit Rate

# Contents

# Index

**ATTENTION**
For information about the safety precautions, read "Safety messages" in this guide.

For information about the software license, read "Software license" in this guide.

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